THE

AMERICAN GAS-LIGHT JOURNAL.

THE OFFICIAL GAZETTE OF

LIGHT, HEAT, WATER-SUPPLY, AND SEWERAGE.

Rooms—No. 39 Nassau Street, cor. Liberty Street, opposite the Post-Office, New York.

VOL. V.—No. 98. NEW YORK, FRIDAY, JANUARY 15, 1864. $3 PER ANNUM.

GENERAL BUTLER AND THE NORFOLK GAS COMPANY.

The gas light company of Norfolk, Va., having closed their works, and permitted the city to remain in darkness for six or eight months, General Butler ordered the establishment to be seized. The directors, all of them being arrant rebels, protested against the action of the General, arguing that they had certain "constitutional rights" which the military authorities were bound to respect. General Butler did not see the matter in that light, but addressed the following letter to Brigadier General Barnes, commanding the United States forces at Norfolk:

"HEADQUARTERS EIGHTEENTH ARMY CORPS, DEPT. OF VIRGINIA AND NORTH CAROLINA, FORTRESS MONROE, VA., Dec. 29, 1863.

"General,—I have received your communication of the 24th of December, to A. T. M. Cooke, Esq, chairman of the stockholders' meeting of the Norfolk Gas Company, covering the letter of Mr. Cooke to yourself, relating to the taking of the Norfolk Gas-Works by the military authorities of the United States, and beg that you will forward him this communication in reply.

"Mr. Cooke claims for the Gas Light Company that they possess very valuable works, for which they now claim large compensation from the Government; that the majority of the stockholders have duly conformed to the requirements of General Order No. 49, and that the company were about putting the works in order when they were taken by the Government for military purposes, in violation of the constitutional rights of the stockholders.

"It will be observed, first, that until within a few days the majority of the stockholders have acknowledged and are known as having been in rebellion against the Government of the United States, and as having endeavored to overthrow that constitution about which they now so glibly talk, and have only just now taken the oath of allegiance to that Government which they have sought to destroy, in conformity to the requirements of a military order. And even now, under these peculiar circumstances, with the oath fresh in their mouths, in a communication from the stockholders to the agents of the Government, with their claims of new-fledged rights frequently repeated, the word loyalty or allegiance to the Government never finds place. They say that they have conformed to the requirements of General Order No. 49. That order requires of them nothing, and more than one of them have said, as I am informed and believe, that they took the oath to save their property, and that they claim, not that they are loyal, but that they have taken out a protection.

"Such men, loyal with lip-service only, so far as I am concerned, have few constitutional rights which I feel much inclined to respect. When they become loyal in heart as on lip, and speak of taking the oath of allegiance to their country, not as a requirement, but as a duty, it will be time enough to discuss their constitutional rights. If their property is as valuable as they claim it, why have the company left it to go to ruin for many months, without any attempt on their part to put the gas-works in operation and light the city? Did their rebellious proclivities overcome even their love of gain, so that they were willing to sacrifice their property rather than to aid the Government of the United States by lighting it, in protecting their city from the robber, the burglar, and the incendiary? Is it not true that they have refused the military authorities of the United States, more than once, to light the city, and continued in that refusal until after they were informed that the works were to be seized upon for that purpose, and the Government had incurred expenses in that behalf?

"I should be quite inclined, as an act of justice, to promise them in future a monthly average rent equal to what they have received for the past nine months, as a compensation from the Government for the use of their works. Their chairman talks of the economical management of the company as compared with the prospective management of the Government, and he certainly ought to be quite satisfied if he is assured from the Government the same rent which he had received under his own management. Exactly what will be done is this: the works will be put in repair, more economically by twenty per cent. than the estimate which was made for the company for the repair of the works. They will be carried on efficiently and economically, so that the city of Norfolk will be fully lighted, and its peace and quietness in the darkness of the night be assured, until it is made certain that, in case of an attack upon the city of Norfolk, the rebel proclivities of the owners will not leave the city in darkness, as a means of impairing the defence made by the United States forces, and when the owners have by their works, and not by their lips, convinced the military authorities that they can rely upon their loyalty for aid in repelling an invasion of the rebels, and a keeping up of the works to aid us in that behalf; then, and not until then, will the works be returned to their custody. In the meantime accurate accounts will be kept of the receipts and expenditures, and the excess of profits, which no doubt will be considerable, will be paid to those who are loyal in the sense of the word as understood by loyal men.

"You are at liberty, General, if you please, to cause this communication to be published for the information of other citizens, if any in Norfolk, who stand in like case.

"I have the honor to be, very respectfully, yours,

"B. F. BUTLER,

"Major-General Commanding.

"To Brigadier-General James Barnes, commanding at Norfolk."

LEGAL INTELLIGENCE.

An important case has been tried in Philadelphia, which will prove interesting to gas companies, particularly to those owned by municipal corporations. The Philadelphia papers describe the case as follows:

UNITED STATES DISTRICT COURT—JUDGE CADWALADER.—The City of Philadelphia *vs.* John H. Diehl. This was an action brought to recover back $28,742, paid under protest to the defendant, as Collector of Internal Revenue for the United States, for taxes on gas used in lighting the city lamps. The taxes were paid for the period extending from September, 1862, to June, 1863, inclusive, and were claimed under the seventy fifth section of the Internal Revenue Law of July, 1862.

The plaintiffs, by counsel, contended that the Gas-Works being the property of the city, and not an independent corporation, and that the gas in question being manufactured for its own uses, did not come within the provisions of the tax law, and should, therefore, be exempt.

The evidence was heard on Saturday, January 2d, and on the 6th inst. was argued by counsel, District Attorney Coffey and Assistant District Attorney Ashton appearing for the United States, and Richard Ludlow, F. C. Brewster, and William L. Hirst, Esqs., for the city.

The argument having been concluded, counsel for plaintiffs submitted the following points, upon which they desired the Judge to charge the jury:

I. That if the jury believe the evidence in the cause, they may find a verdict for plaintiffs for the amount claimed.

II. That if the jury believe that the plaintiffs paid to defendants the sums claimed in this case under protest, and under duress of threats of seizure of their property, they are entitled to recover back the sums so paid.

III. That the provisions of the Acts of Congress imposing a tax on gas do not apply to gas manufactured and used by the Municipal Corporation, plaintiffs, for public lamps under their corporate duty to light the public highways of the city of Philadelphia.

IV. That if the jury believe, from the evidence, that the gas on which the taxes have been paid to the defendant, under protest, was "manufactured or made and sold, or removed for consumption or delivery to others than agents for plaintiffs," the plaintiffs are entitled to recover the taxes paid.

V. That if the jury believe, from the evidence, that the gas upon which the taxes have been paid to defendant, under protest, was manufactured by the plaintiffs, "not for sale, but for their own use and consumption," the plaintiffs are entitled to recover back the taxes so paid.

Upon the foregoing points thus submitted, Judge Cadwalader instructed the jury, that if the gas on which the taxes in question were paid was not furnished for lighting street lamps, and was not manufactured or made and sold, or removed for consumption or for delivery to others than agents of the manufacturer, the verdict should, upon the evidence, be for the plaintiff; but that the said gas, if it was furnished for lighting the lamps in the streets of the city of Philadelphia, under the provisions of the ordinances of the said city and the laws of the State of Pennsylvania, which have been given in evidence, was liable to the tax imposed by the act of Congress of the 1st of July, 1862.

On the points upon which the Court was requested to charge the jury, they were further instructed that if the taxes in question were not due when paid, the evidence that the payments thereof were made under protest entitles the plaintiffs to a verdict.

Except as the said points were answered under this and the previous instructions just given, the Court refused to give the instructions asked on the part of plaintiffs.

The jury, after short deliberation, rendered a verdict for plaintiffs. Counsel for the United States immediately asked for a new trial, which the Court intimated would be granted.

EXPLOSION OF A GAS CARBURATOR.—A man named Daniel Reynolds, aged twenty-three years, was recently killed in England by the explosion of a gas carburetting apparatus. The apparatus was arranged so that ordinary gas was compelled to pass over a light hydrocarbon, by which its illuminating power was increased. The carburetting liquid was being poured into the vessel while a candle was held near by, when the vapor took fire and exploded, throwing the inflammable fluid over the unfortunate man, who was so terribly burned that he soon after expired. The verdict of the coroner's jury was "Accidental death."

GAS-LIGHT COMPANIES IN THE UNITED STATES.

Compiled from official sources expressly for the AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

When Chartered.	Town.	State.	Chartered Capital.	Par Val. Per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1857	ADRIAN	Mich.	50,000	50	—	May & November.	4,000	3 50	....	....	
1856	AKRON	O.	20,000	33⅓	—	Do.	3,500	3 00	....	....	
1845	ALBANY	N. Y.	25 ,000	20	4	January & July.	65,000	3 00	120	....	None in market.
1858	ALBION	N. Y.	30,000	100	—	Do.	3,000	3 50	....	....	
1851	ALEXANDRIA	Va.	106,580	—	—	City Works.	9,000	3 50	....	....	
1852	ALLEGHANY	Pa.	200,000	25	4	May & November.	25,000	3 00	....	....	
1853	ALLENTOWN	Pa.	60,000	100	3½	Do.	5,000	3 50	....	....	
1857	ALTON	Ill.	75,000	—	—	Private Works.	4,000	3 50	....	....	
1859	ALTOONA	Pa.	40,000	20	4	January & July.	5,000	3 00	....	....	
1859	AMESBURY AND SALISBURY	Mass.	30,000	25	—	Do.	7,000	4 00	....	....	
1858	ANNAPOLIS	Md.	100,000	25	—	Do.	4,000	4 00	....	....	
1858	ANN ARBOR	Mich.	23,000	50	5	March & September.	5,500	4 00	....	....	
1858	ASTORIA	N. Y.	20,000	50	—	Do.	6,000	4 00	....	....	
1855	ATLANTA	Ga.	50,000	25	5	January & July.	12,000	5 00	....	....	
1857	ATTLEBORO'	Mass.	6,000	50	3	Do.	2,000	6 00	....	....	
1850	AUBURN	N. Y.	80,000	50	5	Do	10,000	7 00	....	....	
1851	AUGUSTA	Ga.	80,000	25	8	Do.	9,000	6 00	....	....	
1853	AUGUSTA AND HALLOWELL	Me.	84,700	50	5	Do.	10,000	4 00	....	....	
1860	AURORA	Ind.	10,000	—	—	Private Works.	3 500	3 50	....	....	{ Formerly used Sanders' Water-Gas. Recently altered to Coal Gas-Works.
1817	BALTIMORE	Md.	550,000	100	5	June & December.	150,000	2 50	150	....	None for sale.
1852	BANGOR	Me.	120,000	100	2½	January & July.	12,000	3 00	100	....	
1855	BATAVIA	N. Y.	32,000	20	4	Do.	2,500	4 00	100	100	Stock firm. Good works and well managed.
1853	BATH	Me.	65,000	100	3	April & October.	10,000	3 75	....	....	
1859	BATH	N. Y.	15,000	50	—	May & November.	3,000	7 00	....	....	
1861	BATTLE CREEK	Mich.	15,000	—	—	January & July.			....	....	
1858	BELFAST	Me.	14,000	100	—	Do.	7,000	7 00	....	....	
1856	BELLEFONT	Pa.	20,000	25	2	Do.	3,500	4 00	....	....	
	BELOIT	Wis.	30,000	—	—	Do.	4,000	4 00	....	....	
1854	BETHLEHEM	Pa.	50,000	50	4	June & December.	2,000	3 20	....	....	
1859	BEVERLY	Mass.	40,000	100	—	January & July.	4,000	4 00	....	....	
1853	BINGHAMPTON	N. Y.	50,000	50	3½	Do.	10 000	4 00	....	....	
1859	BIRMINGHAM	Pa.	40,000	50	—	Do.	4,000	4 00	....	....	
1855	BLOOMINGTON	Ill.	40,000	50	—	Do.	6 000	4 00	....	....	
1856	BORDENTOWN	N. J.	50,000	25	3	June & December.	4,000	3 50	....	....	
1822	BOSTON	Mass.	1,000,000	500	5	Do.	150,000	2 25	....	....	
1859	BRATTLEBORO'	Vt.	21 000	—	—	Do.	3,000	4 00	....	....	
1851	BRIDGEPORT	Ct.	90,000	25	4	January & July.	10,000	4 00	90	....	Passed last dividend.
1857	BRIDGETON	N. J.	50,000	20	—	Do.	5,000	4 00	....	....	
1856	BRISTOL	Pa.	30,000	25	3	February & August.	3,000	4 00	....	....	
1855	BRISTOL	R. I.	35,000	50	2	January & July.	6,000	4 00	....	....	
1859	BROCKPORT	N. Y.	25,000	100	3	Do.	1,500	4 00	....	....	
1858	BROOKLINE	Mass.	66,000	100	3½	February & August.	3,500	3 50	....	....	
1825	BROOKLYN	N. Y.	2,000,000	25	5	January & July.	75,000	2 50	170	160	
	BROWNSVILLE	Pa.				Do.			....	....	
1848	BUFFALO	N. Y.	600,000	50	5	Do.	70,000	2 90	140	125	
1852	BURLINGTON	N. J.	100,000	25	3½	Do.	5,000	4 00	105	....	
1853	BURLINGTON	Vt.	75,000	25	2½	Do.	10,000	4 50	....	....	
1859	BURLINGTON	Iowa.	65,000	50	—	Do.	8,000	4 00	....	....	
1861	CALAIS	Me.	90,000	100	—	Do.	10,000	3 50	....	....	
1852	CAMBRIDGE	Mass.	800,000	100	5	February & August.	20,000	3 50	100	97½	
1852	CAMDEN	N. J.	800,000	100	3	April & October.	15,000	3 85	105	100	
1853	CANANDAIGUA	N. Y.	50,000	50	—	January & July.	3,000	4 00	90	80	
1856	CANTON	O.	19,000	50	6	March & September.	6,000	3 00	....	....	
1853	CAPE ISLAND	N. J.	80,000	100	—	October.	10,000	6 00	....	....	{ Watering place.—These Works only run in summer.
1860	CARBONDALE	Pa.	16,000	25	—	March & September.	5,000	4 00	....	....	
1855	CARLISLE	Pa.	30,000	25	—	January & July.	4,000	4 00	.. ..	...	
1856	CATASAUQUA	Pa.	15,000	25	5	May & November.	2,000	4 00	....	....	
1858	CATSKILL	N. Y.		—	—	Private Works.	3,000	3 00	....	....	Owned by G. T. Sutton.
1857	CHAMBERSBURG	Pa.	30,000	25	-	January & July.	3,000	4 00	....	....	
1846	CHARLESTON	S. C.	723,800	25	4	Do.	50,000	4 00	....	....	
1851	CHARLESTOWN	Mass.	200,000	50	4	Do.	30,000	3 00	105	.. ..	
1858	CHARLOTTE	N. C.	14,000	50	10	March & September.	3,500	6 00	....	....	
1859	CHARLOTTEVILLE	Vt.	15,000	25	—	Do.	4,000	4 50	....	....	
1851	CHELSEA	Mass.	100,000	100	3½	January & July.	8,000	3 50	....	....	
1856	CHESTER	Pa.	35,000	25	3	April & October.	4,000	4 00	....	....	
1849	CHICAGO	Ill.	1,900,000	25	5	January & July.	100,000	2 50	150	140	Very scarce. Stock wanted.
1857	CHICOPEE	Mass.	50,000	20	—	Do.		4 00	....	....	
1851	CHILLICOTHE	O.	40,000	25	4	Do.	12,000	3 50	....	....	
1841	CINCINNATI	O.	1,600,000	100	5	Do.	225,000	2 50	....	....	
1859	CITIZENS', BROOKLYN	N. Y.	1,000,000	20	—	Do.	135,000	3 00	128	125	
1860	CITIZENS', READING	Mass.	90,000	100	—				....	....	
	CLARKESVILLE	Tenn.	100,000	50	—	Do.	5,000	4 00	....	....	
1860	CLAREMONT	N. H.	20,000	100	—	March & September.	3,000	4 00	....	....	
1846	CLEVELAND	O.	200,000	10	5	January & July.	20,000	3 00	....	....	
1858	CLINTON	Mass.	30,000	500	5	Do.	3,000	4 00	....	....	
1859	CLYDE	N. Y.	10,000	50	4	Do.	2,500	4 00	....	....	
1854	COHOES	N. Y.	50,000	20	3½	April & October.	5,000	3 60	....	....	
1860	COLD SPRING	N. Y.	30,000	50	—	Do.	3,500	4 00	95	....	{ Formerly Rosin-Gas, but now Coal. A well managed company. Stock firmly held.
1860	COLD WATER	Mich.	25,000	50	5	January & July.	4,000	4 00	....	....	
1852	COLUMBIA	Pa.	37,500	25	—	Do.	4,000	3 50	....	....	
1852	COLUMBIA	S. C.	44,000	25	4	Do.	6,000	6 00	....	....	
1857	COLUMBIA	Cal.	50,000	25	—	Do.	4,500	10 00	....	....	
1858	COLUMBUS	Ga.	54,000	25	5	Do.	5,000	7 00	....	....	
1850	COLUMBUS	O.	100,000	10	6	Do.	30,000	3 00	....	....	
1858	CONCORD	N. H.	50 000	50	5	Do.	8,000	3 50	....	....	
1858	COVINGTON AND NEWPORT	Ky.	100,000	50	3½	Do.	28,000	4 00	....	....	
1854	CUMBERLAND	Md.	60,000	50	3	Do.	6,000	4 00	....	....	
1857	DANBURY	Ct.	50,000	25	4	Do.	2,000	3 75	....	....	
1856	DANVILLE	Pa.	30,000	25	—	June & December.	3,000	4 00	....	....	
1855	DAVENPORT	Iowa.	56,000	100	—	Do.	6,000	5 00	....	....	
1848	DAYTON	O.	50,000	25	5	February & August.	8,000	3 50	....	.. ..	
1853	DEDHAM	Mass.	40,000	50	—	January & July.	3,000	4 00	....	....	
1860	DELAWARE	O.	30,000	25	—	Do.	2,500	3 00	....	....	
1849	DETROIT	Mich.	500,000	50	5	Do.	30,000	3 50	160	150	Excellent Stock. No sales.
1860	DOBBS' FERRY	N. Y.	25,000	—	—	Do.	3,000	4 00	....	....	
1854	DORCHESTER	Mass.	150,000	100	—	Do.	14,000	4 00	....	....	
1859	DOVER	Del.	12,000	—	—	Private Works.	2,000	4 00	....	....	
	DOVER	N. H.				January & July.			....	....	
1857	DOYLESTOWN	Pa.	50,000	—	—	Do.	3 000	4 00	....	....	
1854	DUBUQUE	Iowa.	50,000	115	3½	Do.	17,000	4 50	....	115	This stock is wanted at par.
1853	EAST BOSTON	Mass.	133,000	25	4	Do.	20,000	3 50	....	145	
1858	EAST GREENWICH	R. I.	11,200	100	15	Do.	3,000	7 00	....	....	No transactions.
1861	EAST HAMPTON	Mass.	10,000	25	—	Do.	5,000	9 00	....	....	
1861	EAST NEW YORK	N. Y.	50,000	50	—	Do.	12,000	3 50	....	....	
1857	EASTON	Md.	9,000	10	—	Do.	1,500	7 00	....	....	
1850	EASTON	Pa.	125,000	50	4	June & December.	6,000	3 60	....	....	
1856	EASTPORT	Me.	50,000	55	—	Do.	3 000	4 00	....	....	
1855	ELIZABETH	N. J.	100,000	20	4	January & July.	14,000	3 50	....	....	
	ELLICOTT'S MILLS	Md.	10,000	—	—	Do.	4,000	4 00	....	....	
1852	ELMIRA	N. Y.	50,000	25	3½	Do.	5,000	4 00	....	....	
1852	ERIE	Pa.	68,000	50	3½	June & December.	10 000	3 00	....	....	
1853	EVANSVILLE	Ind.	60,000	50	4	January & July.	12,000	4 00	110	....	
	EXETER	N. H.	60,000	—	—	Do.	12,000		....	....	A very good Company.
	FAIR HAVEN	Ct.	20,000	25		Do.	8,000	4 00	....	....	
1847	FALL RIVER	Mass.	26,000	—	—	Private Works.	12,000	3 50	....	....	
1859	FAYETTEVILLE	N. C.	25,000	100	6	January & July.	7,000	6 00	....	....	
	FIFTH WARD (Milwaukee)	Wis.	50,000	25	—	Do.	10,000	4 00	....	....	
1857	FISHKILL	N. Y.	10,000	20	—	April & October.	1,500	9 00	....	....	
1853	FITCHBURG	Mass.	100,000	50	3	January & July.	5,000	4 00	....	....	Make Petroleum-Gas.
1859	FLEMINGTON	N. J.	20,000	—	—	Do.	3,000	4 00	....	....	
1855	FLUSHING	N. Y.	20,000	50	1½	March & September.	6,500	4 00	....	....	
1858	FOLSOM	Cal.							....	....	
	FORT WAYNE	Ind.	40,000	25	—	Do.	6,000	4 00	....	....	
1851	FRANKFORT	Ky.	50,000	—	—	City Works.	5,500	4 50	....	....	
1851	FREDERICK CITY	Md.	36,000	100	—	January & July.	5,000	6 70	....	....	
1854	FREDERICKSBURG	Va.	72,500	50	5	Do.	4,500	4 00	....	....	
1858	FREDONIA (Natural Gas)	N. Y.	10,000	100	—	Do.	2,000	4 00	....	....	Unlimited supply of Natural Gas.
1856	FREEPORT	Ill.	20,000	100	—	May & November.	10,000	4 00	....	....	

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When Chartered.	Town.	State.	Chartered Capital.	Par Val. Per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1870	Fremont	O.	25,000	25	—	May & November.	2,000	4 50	....	....	
1858	Fulton	N. Y.	12,000	100	—	Do.	4,000	7 00	....	....	
1855	Galena	Ill.	70,000	100	—	Do.	8,000	4 00	....	....	
1870	Galion	O.	25,000	25	—	January & July.	1,800	3 00	....	....	
1858	Galveston	Texas.	150,000	50	—	May & November.	7,000	6 00	....	....	
1854	Gardiner	Me.	100,000	50	4	Do.	8,000	4 00	....	....	
1853	Geneva	N. Y.	75,000	25	2½	Do.	6,000	4 00	....	....	
1851	Germantown	Pa.	Merged	into	the	Philadelphia Works.	12,000	2 25	....	....	
1859	Gettysburg	Pa.	20,000	50	3	January & July.	2,500	4 00	....	....	
1854	Glenn's Falls	N. Y.	25,000	50	3	February & August.	4,000	4 00	....	....	
1854	Gloucester	Mass.	40,000	50	—	January & July.	5,000	3 50	....	....	
1857	Gloversville	N. Y.	15,000	25	—	Do.	3,000	3 50	....	....	
1858	Grand Rapids	Mich.	150,000	20	—	Do.	3,000	4 00	....	....	
1855	Great Barrington	Mass.	5,000	100	5	April & October.	2,000	7 00	....	....	
1849	Great Falls	N. H.	50,000	100	3	Do.	3,000	4 00	....	....	
1860	Greenfield	Mass.	20,000	50	2	January & July.	2,500	4 00	....	....	Close corporation.
1853	Greenpoint	N. Y.	100,000	50	5	Do.	20,000	3 00	....	....	
1859	Greensboro'	N. C.	12,000	50	—	April & October.	3,000	7 00	....	....	
1858	Greensburg	Pa.	30,000	25	3	May & November.	2,000	3 00	....	....	
1854	Hagerstown	Md.	15,000	20	—	January & July.	2,000	6 00	....	....	
	Hamilton	O.	15,000			Do.			....	....	
1859	Hannibal	Mo.	100,000	100	—	Do.	6,000	3 50	....	....	
1857	Harlem	N. Y.	350,000	50	3½	Do.	25,000	3 00	....	145	
1855	Harrisburg	Pa.	100,000	—	4	Do.	5,000	4 00	....	....	
1849	Hartford	Ct.	200,000	25	4	Do.	25,000	3 00	150	140	Stock in demand.
	Hastings	N. Y.				Do.	8,000	4 00	....	....	
1853	Haverhill	Mass.	50,000	50	—	Do.	5,000	4 00	....	....	
1859	Haverstraw	N. Y.	20,000	100	—	Do.	5,000	4 00	....	....	
1861	Hayesville	Mass.	15,000	25		Do.	4,000	4 00	....	....	
1859	Hempstead	N. Y.	16,000	25	—	Do.	1,000	4 00	....	....	
1862	Hoboken	N. J.	100,000	25	3	Do.	30,000	2 50	....	100	Works not yet built.
1856	Hollidaysburg	Pa.	30,000	25	2	Do.	4,000	3 50	....	....	
1861	Holyoke	Mass.	20,000	25	—	Do.	3,000	4 00	....	....	
1861	Homer & Cortlandt	N. Y.	40,000	100	—	Do.	6,000	4 00	....	....	
1854	Honesdale	Pa.	30,000	25	3	Do.	2,500	4 00	....	....	
1860	Hornellsville	N. Y.	12,000	50	—	Do.	2,000	4 00	....	....	
1853	Hudson	N. Y.	50,000	100	3½	February & August.	3,000	4 00	....	....	
	Hunter's Point	N. Y.									
1857	Huntington	Pa.	18,000	50	3	Do.	2,000	3 50	....	....	
1856	Huntsville	Ala.	7,325	25	—	June & December.	2,000	5 00	....	....	
	Indianapolis	Ind.	150,000	—	—	Do.	15,000	5 00	....	....	
1857	Iowa City	Iowa.	40,000	50	—	February & August.	4,000	4 50	....	....	
1852	Ithaca	N. Y.	75,000	25	3½	January & July.	6,000	4 00	....	....	
1857	Jackson	Mich.	25,000	50	5	Do.	6,000	3 50	....	....	
	Jackson	Miss.	80,000	50	—	Do.	4,000	4 50	....	....	
	Jackson	Cal.	50,000	30	—	Do.	4,000	10 00	....	....	
	Jacksonville	Flor.	30,000	20	—	Do.	2,000	7 00	....	....	
	Jacksonville	Ind.	50,000	50	—	Do.	4,000	5 00	....	....	
1858	Jacksonville	Mo.	25,000	25	—	Do.	7,000	6 00	....	....	
1856	Jamaica	N. Y.	20,000	—	4	Do.	6,000	4 00	....	....	
1853	Jamaica Plain	Mass.	75,000	100	3½	Do.	3,000	3 50	....	....	
	Jamestown	N. Y.	25,000	—	—	Do.	4,000	4 00	....	....	
1856	Janesville	Wis.	50,000	160	—	Do.	12,000	4 00	....	....	
	Jeffersonville	Md.	30,000	25		Do.	4,000	4 00	....	....	
1853	Jersey City	N. J.	300,000	—	5	Do.	30,000	3 03	150	....	No sales since formation of Hoboken Co.
1858	Jersey Shore	Pa.	15,000	25	—	Do.	2,000	3 70	....	....	
1856	Johnstown	Pa.	80,000	25	3	Do.	8,000	3 00	....	....	
1857	Joliet	Ill.	300,000	100	—	June & December.	6,000	4 00	....	....	
1858	Kalamazoo	Mich.	30,000	50	5	Do.	10,000	4 00	....	....	
1860	Keene	N. H.	60,000	100	—	Do.	4,500	4 00	....	....	
1855	Keokuk	Iowa.	100,000	100	—	January & July.	10,000	4 50	....	....	
1855	Kingston	Pa.	50,000	50	—	Do.	3,000	4 00	....	....	
1850	Kittanning	Pa.	20,000	—	—	Doubtful.	5,000	4 00	....	....	Said to be a fraud.
1854	Knoxville	Tenn.	63,000	—	—	April & October.	4,000	5 00	....	....	
1860	Laconia	N. H.	20,000	100	—	Do.	4,000	6 00	....	....	
1859	La Crosse City	Wis.	100,000	50	—	June & December.	10,000	8 00	....	....	Petroleum and Wood Gas.
1854	Lafayette	Ind.	60,000	50	4	January & July.	10,000	3 25	....	....	
1856	Lambertville	N. J.	30,000	25	—	Do.	2,600	4 00	....	....	
1849	Lancaster	Pa.	100,000	50	4	Do.	10,000	3 00	....	....	
1856	Lancaster	O.	25,000	100	5	Do.	5,000	3 50	....	....	
1855	Lansinburg	N. Y.	25,000	100	—	Private Works.	7,000	4 00	....	....	
1849	Lawrence	Mass.	200,000	100	4	February & August.	15,000	3 50	....	....	
1859	Leavenworth	Kansas.	200,000	25	—	Private Works.	15,000	4 00	....	....	
1856	Lebanon	Pa.	26,000	50	—	February & August.	5,000	4 00	....	....	
1861	Le Roy	N. Y.	25,000	50	—	Do.	4,000	4 00	....	....	
1858	Lewisburg	Pa.	20,000	100	—	January & July.	4,000	4 00	....	....	
1852	Lewiston	Me.	100,000	100	3	Do.	10,000	3 29	....	....	
1856	Lewistown	Pa.	30,000	50	3	April & October.	3,000	3 10	....	....	
1853	Lexington	Ky.	100,000	25	4	January & July.	5,000	4 00	....	....	
1853	Little Falls	N. Y.	112,000	25	—	Do.	3,500	7 00	....	....	
1861	Little Rock	Ark.	20,000	—	—	Do.	5,000	6 00	....	....	
1858	Lockhaven	Pa.	28,000	—	—	Do.	3,000	4 00	....	....	
	Lockport	N. Y.	100,000	50	—	Do.	4,000	4 00	....	....	
	Logansport	Ind.	40,000		5	April & October.	5,000	4 00	105		
1838	Louisville	Ky.	600,000	50	6	January & July.	60,000	2 50	125	....	But $481,400 stock has been sold. This Company has a large contingent fund and undivided profits on hand.
1849	Lowell	Mass.	200,000	25	5	Do.	50,000	3 25	....	....	
1852	Lynchburg	Va.	70,000	25	5	Do.	6,000	3 50	....	....	
1852	Lynn	Mass.	55,000	50	4	Do.	20,000	4 00	....	....	
1859	Lyons	N. Y.	30,000	100	—	Do.	4,000	4 00	....	....	
1852	Macon	Ga.	75,160	25	6	Do.	5,000	5 00	....	....	
1851	Madison	Ind.	160,000	25	3	Do.	10,100	3 50	....	....	
1855	Madison	Wis.	100,000	25	—	Do.	5,000	5 00	....	....	
1854	Malden & Melrose	Mass.	50,000	25	3	February & August.	5,000	4 00	....	....	
1852	Manayunk	Pa.	40,000	100	—	Do.	7,000	4 00	....	....	
1852	Manchester	N. H.	100,000	100	5	January & July.	25,000	3 00	....	....	
1830	Manhattan (N. Y. City)	N. Y.	4,000,000	50	5	Do.	600,000	2 50	....	....	
	Mansfield	O.	25,000	—	—	Do.	10,000	4 00	....	....	
1854	Marblehead	Mass.	40,000	100	3	Do.	1,000	4 00	....	....	
	Marlboro'	Mass.	20,000	—	—	Do.	8,000	4 00	....	....	
	Mauch Chunk	Pa.	50,000	50	—	Do.	7,000	4 00	....	....	
1857	Marietta	O.	50,000	50	—	Do.	7,000	4 00	....	....	Stock firm.
1860	Marion	O.	12,000	25	5	April & October.	1,500	18 55	....	....	
1858	Marysville	Cal.	50,000	100	—	January & July.	4,000	2 50	....	....	
1857	Massilon	O.	20,000	25	—	Do.	5,000	3 00	....	....	
1855	Meadville	Pa.	39,500	25	—	Do.	4,000	3 50	....	....	
	Medina	N. Y.	2,000	100	—	Do.	2,000	7 00	....	....	
1852	Memphis	Tenn.	300,000	100	5	June & December.	12,000	3 50	....	....	
	Meriden	Ct.	20,000			Do.			....	....	
1850	Metropolitan (N. Y. City)	N. Y.	1,000,000	100	—	January & July.	200,000	2 50	....	....	
1870	Middleboro'	Mass.	15,000	—	—	Private Works.		6 00	....	....	
1853	Middletown	Ct.	50,000	25	3	March & September.	5,000	3 80	....	....	Owned by G. T. Sutton.
	Middletown	N. Y.		25	—	Private Works.	3,000	3 00	....	....	
	Milford	Mass.	20,000	—	—	Do.		4 00	....	....	
	Milledgeville	Ga.	100,000	50	—	Do.		5 00	....	....	
	Milton	Pa.	10,000			Do.			....	....	
1847	Milwaukee	Wis.	400,000	50	5	January & July.	24,000	3 50	150	....	
1852	Mobile	Ala.	200,000	—	—	Do.	30,000	4 50	....	....	
1856	Monroe	Mich.	40,000	50	—	Do.	5,000	3 50	50	....	
1852	Montgomery	Ala.	100,000	25	4	February & August.	7,000	6 00	....	....	
1856	Montpelier	Vt.	30,000	25	3	January & July.	5,000	4 50	....	....	
1859	Morrisania	N. Y.	30,000	50	—	Do.		4 00	....	....	
1859	Morristown	N. J.	18,000	50	—	Do.	3,500	4 00	....	....	
1854	Mount Holly	N. J.	16,650	25	3	April & October.	2,000	7 00	....	....	
	Mount Vernon	O.	50,000	100	—	Do.		4 00	....	....	
1857	Muscatine	Iowa.	50,000	100	—	January & July.	3,000	4 50	....	....	
1854	Nantucket	Mass.	50,000	100	3	February & August.	6,000	4 00	....	....	

GAS-LIGHT COMPANIES IN THE UNITED STATES.—Continued.

Compiled from official sources expressly for the AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

When Chartered.	Town.	State.	Chartered Capital.	Par Val. per Sh. $	Semi-Ann'l Div.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1852	Nashua	N. H.	45,000	50	3½	January & July.	10,000	3 50	....	....	
1850	Nashville	Tenn.	260,000	50	5	Do.	25,000	3 50	....	...	
1858	Natchez	Miss.	46,000	50	—	Do.	20,000	5 00	...	...	
	Nevada City	Cal.							....	....	
1852	New Albany	Ind.	200,000	50	3½	Do.	16,000	3 50	....	...	
1846	Newark	N. J.	362,000	50	5	Do.	45,000	3 62	180	...	Always a favorite stock.
1856	Newark	O.	30,000	100	—	Do.	7,000	5 40	....	....	
1852	New Bedford	Mass.	130,000	100	5	Do.	15,000	2 90	102	.. .	Well managed and kept quiet.
1859	Newbern	N. C.	22,000	100	6	Do.	6,000	3 50	....	....	
	New Britain	Ct.	30,000	20	5	Do.	3,000	4 00	...	....	
1851	New Brunswick	N. J.	100,000	20	4	Do.	8,000	3 00	115	....	
1852	Newburg	N. Y.	67,000	20	4	Do.	10,000	4 00	105	....	
1852	Newburyport	Mass.	150,000	10	4	Do.	9,000	4 00	92½	....	
1857	Newcastle	Del.	32,300	10	3	Do.	4,000	4 00	90	....	
1847	New Haven	Ct.	250,000	25	4	Do.	30,000	3 00	155	....	None in market.
1853	New London	Ct.	70,000	50	3	Do.	12,000	4 00	105	....	
1835	New Orleans	La.	1,500,000	100	6	Do.	120,000	4 00	180	....	
1853	Newport	R. I.	180,200	100	4	Do.	10,000	3 50	112	....	
1854	Newton & Watertown	Mass.	300,000	100	2	Do.	10,000	4 00	....	....	
	Newton	N. J.	30,000	—	—	Do.	3,000	4 00	....	....	
	Newton	Pa.	20,000	50	—	Do.	2,500	4 00	....	....	
	Newtown	N. Y.									
1823	New York	N. Y.	1,000,000	50	5	May & November.	100,000	2 50	300	....	
1859	Niagara Falls	N. Y.	15,000	25	—	Do.	3,000	4 00	90	....	
	Norfolk	Va.	60,000	25	—	Do.	40,000	4 00	....	....	
1853	Norristown	Pa.	41,700	25	4	June & December.	8,000	3 50	....	...	
1855	North Attleboro'	Mass.	50,000	100	3½	Do.	6,000	4 00	....	....	
	Northern Liberties	Pa.	400,000	25	7	City Works.	40,000	2 50	....	....	
	North Adams	Mass.	25,000	—	—	March & September.	30,000	4 00	....	.. .	
1856	Northampton	Mass.	85,000	25	3	January & July.	4,500	4 00	....	....	
1859	North Bridgewater	Mass.	16,000	100	4	June & December.	1,000	7 00	....	....	
1856	Norwalk	Ct.	30,000	150	4	February & August.	6,000	4 00	....	....	
1859	Norwalk	O.	30,000	25	—	January & July.	4,000	4 00	....	....	
1854	Norwich	Ct.	75,000	25	3½	Do.	12,000	3 50	....	....	
1861	Norwich	N. Y.	12,000	50	—	Do.	2,500	4 00	....	. ..	
1859	Nyack	N. Y.	20,000	100	—	Do.	2,500	4 00	....	....	
1860	Oberlin	O.	10,000	—	—	Do.	1,200	4 00	....	...	
1855	Ogdensburg	N. Y.	75,000	50	5	Do.	9,000	4 00	....	.. .	
1859	Orange	N. J.	65,000	25	—	Do.	6,000	3 50	....	....	
1852	Oswego	N. Y.	81,250	100	3½	Do.	15,000	4 00	105	....	
1855	Ottawa	Ill.	45,000	100	6½	Do.	6,000	4 00	....	....	Good works, built by Hoy, Jr., & Kennedy.
1856	Owego	N. Y.	40,000	50	3½	Do.	5,000	4 00	....	....	
1860	Owensboro'	Ky.	25,000	25	—	Do.	4,000	3 50	....	....	
1856	Paducah	Ky.	75,000	100	—	May & November.	4,000	5 00	....	....	
1861	Painsville	O.	40,000	25	5	Do.	2,500	5 00	....	.. .	
1856	Palmyra	N. Y.	12,000	25	—	January & July.	5,000	7 00	....	....	
1847	Paterson	N. J.	125,000	25	3	Do.	20,000	3 50	95	....	
1850	Pawtucket	R. I.	75,000	50	4	Do.	12,000	3 00	....	....	
1855	Peekskill	N. Y.	31,000	50	3	June & December.	4,000	4 00	....	....	Surplus $10,000, May 15, 1863.
1860	Penn Yan	N. Y.	12,000	50	5	Do.	3,000	4 00	....	....	Works leased to Gilbert T. Sutton.
1859	Peoples', Chicago	Ill.	500,000	50	New	Do.	100,000	2 50	....	....	
1855	Peoria	Ill.	100,000	50	4	Do.	8,000	3 50	....	....	What is this Company doing?
1852	Petersburg	Va.	120,000	—	5	January & July.	20,000	3 50	....	....	
1841	Philadelphia	Pa.	8,000,000	50	—	City Works.	650,000	2 50	....	....	
1855	Piqua	O.	50,000	50	—	January & July.	6,500	4 00	....	....	
1835	Pittsburg	Pa.	300,000	100	5	Do.	60,000	1 50	115	....	
1854	Pittsfield	Mass.	50,000	100	5	Do.	4,500	4 00	....	....	
1858	Placerville	Cal.	30,000	50	—	Do.	4,500	10 00	....	....	
1860	Plainfield	N. J.	25,000	50	—	Do.	2,500	4 00	....	....	
1859	Plattsburg	N. Y.	16,000	50	—	January & July.	5,000	7 00	....	....	
1853	Plymouth	Mass.	40,000	100	—	April & October.	8,000	4 00	....	....	
1860	Port Chester	N. Y.	50,000	50	—	Do.	4,000	4 00	....		
1860	Port Jervis	N. Y.	20,000	100	—	Do.	3,000	4 10	....	...	
1849	Portland	Me.	300,000	50	4	January & July.	30,000	3 00	....	....	
1859	Portland	Oreg.	50,000	50	—	Do.	3,500	3 00	....	....	
1859	Port Lavacca	Texas.	50,000	100	—	Do.	2,500	7 00	....	....	
1851	Portsmouth	N. H.	70,000	100	8	April & October.	6,500	3 70	....	....	
1855	Portsmouth	O.	50,000	50	4	January & July.	10,000	3 50	....	....	
1855	Portsmouth	Va.	100,000	50	4	Do.	4,000	4 00	....	....	
1856	Pottstown	Pa.	20,000	50	3	Do.	3,500	4 00	....	....	
1850	Pottsville	Pa.	110,000	50	2	Do.	10,000	3 50	....	....	
1850	Poughkeepsie	N. Y.	84,000	25	4	March & September.	15,000	3 50	120	110	
1848	Providence	R. I.	1,000,000	50	4	January & July.	60,000	3 00	122	....	
1858	Quincy	Ill.	300,000	50	4	June & December.	12,000	3 50	....	....	
	Quincy	Mass.	60,000	00	—	Do.	00,000	0 00	....	....	
1855	Racine	Wis.	43,500	26	—	Do.	7,000	3 50	....	....	
1857	Rahway	N. J.	50,000	20	—	January & July.	5,000	4 00	....	....	
1856	Raleigh	N. C.	25,000	100	6	May & Novrmber.	5,000	6 00	....	....	
1848	Reading	Pa.	100,000	25	4	January & July.	25,000	3 00	....	....	
1851	Richmond	Va.	841,975	—	—	City Works.	80,000	3 00	....	....	Jeff. Davis has extinguished the gas-lights of Richmond, Va.
1859	Richmond	Mass.	40,000	25	—	January & July.	3,000	4 00	....	....	
	Richmond County	N. Y.									
1859	Ripley	O.	25,000	50	—	April & October.	2,000	4 00	....	....	
1852	Rochester	N. Y.	200,000	50	5	January & July.	50,000	2 50	....	....	
1857	Rockford	Ill.	40,000	50	—	Do.	4,000	4 00	....	...	
1854	Rock Island	Ill.	100,000	50	—	Do.	6,000	4 50	....	....	
1854	Rockland	Me.	50,000	100	—	Do.	6,000	4 40	....	.. .	
1852	Rome	N. Y.	85,000	100	3½	Do.	10,000	3 60	....	....	
1854	Rondout and Kingston	N. Y.	65,150	20	3½	June & December.	10,000	3 80	....	....	
1854	Roxbury	Mass.	150,000	100	5	January & July.	20,000	3 50	....	....	
1859	Rutland	Vt.	20,000	25	—	Do.	4,000	3 50	....	....	
	Saco	Me.	71,600	100	3½	April & October.	8,000	4 00	....	....	
1857	Sacramento	Cal.	500,000	100	—	Do.	40,000	10 00	....	....	
1859	Sag Harbor	N. Y.	20,000	—	—	Do.	4,000	4 00	....	....	
1856	Saint Albans	Vt.	15,000	20	—	Do.	3,000	7 00	....	....	
	Saint Johnsbury	Vt.	30,000	25	—	Do.	4,000	4 00	....	....	
1857	Saint Joseph	Mo.	50,000	100	5	January & July.	6,000	5 00	....	....	
1859	Saint Louis	Mo.	600,000	50	—	June & December.	180,000	3 50	....	....	
1857	Saint Paul	Min.	200,000	50	3	January & July.	10,000	6 00	....	....	Surplus $10,000, May 15, 1863.
1856	Salem	N. J.	30,000	25	3	Do.	5,000	3 86	....	....	
1850	Salem	Mass.	200,000	100	4	February & August.	30,000	3 24	..	....	
1859	Salem	O.	25,000	20	—	Do.	3,000	3 00	....	....	
1859	Salisbury	N. C.	14,600	50	6	May & November.	3,500	6 00	....	...	
	Salisbury Mills	Mass.	1,250	25	—	Do.	3,000	4 00	....	....	
	Salmon Falls	Me.	25,000	100	—	Do.	3,000	4 00	....	....	
	San Antonio	Texas.	75,000	20	—	Do.	40,000	6 00	....	....	
1854	Sandusky	O.	75,000	50	—	April & October.	9,000	3 00	....	....	
1859	Sandwich	Mass.	10,000	—	—	Private Works.	2,000	3 50	....	....	
1852	San Francisco	Cal.	2,000,000	100	4½	Do.	100,000	6 50	100	....	
	San Jose	Cal.							....	....	
1853	Saratoga Springs	N. Y.	30,000	100	—	January & July.	6,000	3 60	70	....	
	Saugerties	N. Y.	30,000	20	—	Do.	4,000	3 00	....	....	
1849	Savannah	Ga.	200,000	25	5	Do.	10,000	3 75	....	....	
1851	Schenectady	N. Y.	50,000	—	—	Private Works.	11,000	4 00	....	....	
1858	Scranton, Gas and Water	Pa.	100,000	25	—	January & July.	6,000	3 80	....	....	About trying Water-Gas.
1857	Selma	Ala.	20,000	100	—	Do.	2,000	5 00	....	....	
1856	Seneca Falls and Waterloo	N. Y.	80,000	50	3	Do.	10,000	4 00	100	....	
	Shreveport	La.	40,000	25	—	Do.	3,000	0 50	....	....	
1856	Sing Sing	N. Y.	40,000	100	—	Do.	3,000	3 50	....	....	
	Smyrna	Del.						4 00	....	....	Petroleum Gas.
1860	South Adams	Mass.	10,000	25	—	Do.	3,000	4 00	....	....	
1859	South Bridge	Mass.	5,000	25	—	Do.	4,010	6 00	....	....	
	South Boston	Mass.	200,000	50	—	Do.	60,000	3 25	110	....	
	Springfield	O.	200,000	100	—	Do	20,000	3 50	....	....	
1854	Springfield	Ill.	75,000	50	—	January & July.	10,000	3 50	....	....	
1848	Springfield	Mass.	100,000	500	5	February & August.	10,000	3 60	140	....	
1858	Stamford	Ct.	6,250	25	5	April & October.	3,000	3 50	...	....	
1861	Staten Island	N. Y.	150,000	50	5	January & July.	20,000	4 00	95	....	

GAS-LIGHT COMPANIES IN THE UNITED STATES.—Continued.

Compiled from official sources expressly for the AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

When Chartered.	Town.	State.	Chartered Capital.	Par Val. per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1859	Staunton	Va.	18,000	50	6	January & July.	4,000	7 00	....	....	
	Steubenville	O.	150,000	100	—	Do.	15,000	4 00	....	....	
	Stockton	Cal.	50,000	—	—	Do.	8,000	10 00		....	
1848	Syracuse	N. Y.	125,000	25	5	March & September.	25,000	3 00	112	....	
	Tamaqua	Pa.	40,000	25	—	Do.	3,000	4 00	....	....	
1859	Tarrytown and Irvington	N. Y.	70,000	50	—	January & July.	3,000	4 00	....	....	
1853	Taunton	Mass.	100,000	50	4	Do.	10,000	4 00	....	....	
	Terre Haute	Ind.	100,000	100	—	Do.	3,000	4 00	....	....	
	Thompsonville	Ct.	25,000	50	—	Do.	4,000	4 50	....	....	
	Tiffin	O.	25,000	20	—	Do.	4,000	4 00	....	....	
1853	Toledo	O.	100,000	50	3	Do.	8,000	3 50	....	....	
1847	Trenton	N. J.	100,000	20	4	Do.	15,000	3 42	....	110	
1848	Troy	N. Y.	200,000	100	4	June & December.	35,000	3 00	160	....	
1856	Urbana	O.	30,000	25	—	April & October.	3,500	4 00	....	....	
1849	Utica	N. Y.	80,000	100	4	Do.	22,000	3 60	....	....	
1858	Vicksburg	Miss.	66,000	50	—	March & September.	4,000	4 50	....	....	
1859	Vincennes	Ind.	25,000	100	—	January & July.	2,000	4 00	....	....	
1863	Virginia City.	N. T.					20,000				
1858	Walden	N. Y.	2,500	—	—	Private Works.	1,000	6 00	....	....	
1853	Waltham	Mass.	100,000	100	4	January & July.	3,000	4 00	....	....	
1857	Ware	Mass.	30,000	20	—	Do.	3,500	4 00	....	....	
1861	Warren	O.	30,000	50	—	Do.	4,000	3 00	....	....	
1854	Warren	R. I.	20,000	25	—	Do.	3,000	4 00	....	....	
1855	Washington	D. C.	500,000	20	5	Do.	50,000	2 61	150	148	
1859	Washington	N. C.	15,000	100	—	April & October.	1,500	6 00	....	...	
1848	Washington	Pa.	20,000	25	4	January & July.	4,000	3 00	....	....	
1854	Waterbury	Ct.	100,000	25	—	Do.	4,000	4 00	....	....	
1852	Waterford	N. Y.	12,000	25	—	Do.	4,000	4 00	....	....	
1852	Watertown	N. Y.	20,000	100	—	Do.	10,000	7 00	....	....	
1856	Watertown	Wis.	25,000	100	—	Do.	5,000	5 00	....	....	
1858	Wautoma	Wis.	30,000	50	—	Do.	3,000	4 50	....	....	
1857	Waverly	Miss.	20,000	100	—	April & October.	4,000	5 00	....	....	
1854	West Cambridge	Mass.	60,000	100	—	February & August.	10 000	4 00	....	....	
1852	Westchester	Pa.	100,000	25	2½	Do.	3,500	3 50	....	....	
	Westfield	Mass.	25,000	100	6	Do.	4,000	4 00	....	....	
	Weston	O.	20,000	25	—	Do.		5 00	....	....	
1857	West Point	N. Y.	50,000	—	—	United States Military	Academy.	2 00	....	....	
1853	West Troy	N. Y.	100,000	50	3	January & July.	10,000	3 60	85	....	
1850	Wheeling	Va.	75,000	25	6	Do.	12,000	2 70	....	....	
	White Plains	N. Y.	20,000	20	—	Do.			....	....	
1856	Wilkesbarre	Pa.	50,000	50	—	May & November.	4,000	3 33	100	80	
1850	Williamsburg	N. Y.	1,000,000	50	5	January & July.	60,000	3 00	....	....	
1858	Williamsburg	Va.	30,000	25	—	Do.	3,000	4 00	....	....	Camp-fires of the Union Army light up this place at present.
1857	Williamsport	Pa.	70,000	25	4	Do.	3,500	3 80	....	....	
1859	Willimantic	Ct.	12,000	—	—	Do.	2,500	3 50	....	....	
1853	Wilmington	N. C.	60,000	50	5	Do.	8,000	5 00	....	....	
1852	Wilmington	Del.	200,000	50	5	February & August.	20,000	3 00	....	....	
1854	Winchester	Va.	36,000	50	6	January & July.	5,000	4 00	....	....	
1861	Windsor	Vt.	20,000	25		Do.	2,000	6 00			Make Petroleum Gas.
	Woburn	Mass.	20,000	—	—	Do.	3,000	4 00	....	....	
1856	Woodstock	Vt.	10,000	50	4	Do.	4,000	6 00	....	....	
1853	Woonsocket	R. I.	82,600	100	4	April & October.	4,000	3 50	....	....	
1856	Wooster	O.	25,000	50	—	January & July.	6,000	3 00	....	....	
1849	Worcester	Mass.	160,000	100	5	Do.	15,000	3 50	....	....	
1855	Xenia	O.	40,000	50	—	Do.	3,000	4 00	....	....	
1854	Yonkers	N. Y.	100,000	50	3½	Do.	10,000	3 50	110	16½	
1849	York	Pa.	40,000	57	3	June & December.	10,000	3 50	....	....	
	Yorkville	S. C.	20,000	25	—	Do.	4,000	4 00	....	....	
1858	Ypsilanti	Mich.	20,000	50	5	February & August	6,000	14 00	....	....	
1850	Yreka	Cal.	50,000	100	—	Do.	2,000	0 00	....	....	
1848	Zanesville	O.	44,600	25	4	Do.	10,000	3 00	....	....	

GAS-LIGHT COMPANIES IN THE BRITISH PROVINCES OF NORTH AMERICA.

When Chartered.	Town.	Province	Chartered Capital.	Par Val. per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1854	Belleville	C. W.	33,040	100	4	January & July.	1,200	5 00	....	....	
1854	Brantford	C. W.	32,000	100	2½	Do.			....	....	
	Brockville	C. W.	50,000	—	—	Do.	5,000	4 00	....	....	
	Chatham	N. B.	50,000	—	—				....	....	
1854	Charlotte Town	P. E. I.	50,000	100	5	Do.	3,000	3 50	....	....	
1857	Cobourg	C. W.	30,000	—	-	February & August.	4,000		....	....	
	Dundas	C. W.	30,000	—	—	Do.	6,000	4 00	....	....	
	Frederick	N. B.	50,000	—	—	Do.			....	....	
1843	Halifax	N. S.	160,000	40	7	May.	30,000	3 00	....	....	
1850	Hamilton	C. W.	125,000	40	5	March & September.	20,000	3 50	....	....	
1848	Kingston	C. W.	80,000	100	—	Do.	6,000	3 50	....	....	
1853	London	C. W.	100,000	20	5	May & November.	5,000	5 00	....	....	
1847	Montreal	C. E.	400,000	40	—	March & September.	110,000	2 80	....	113	Last sale at this figure.
1854	Ottawa	C. W.	40,000	40	5	Do.	5,000	4 50	....	....	
1859	Point Levi	C. E.	25,000	25	—	January & July.	4,000	3 50	....	....	
1859	Port Hope	C. W.	28,000	20	4	May & November.	4,500	3 50	....	....	
1847	Quebec	C. E.	200,000	200	4	January & July.	60,000	3 00	....	....	
1848	Saint Catherine's	C. W.	80,000	20	—	May & November.	7,000	4 50	....	....	
1859	Saint Hyacinthe	C. E.	15,000	20	—	Do.	4,000	4 00	....	....	
	Saint John	N. B.	170,000	85	4	June & December.	25,000	3 00	110	110	Sales at this figure.
	Saint John's	N. F.	50,000	—	4	Do.	30,000		....	....	
1858	Sorel	C. E.	14,000	20	4	Do.	4,000	3 00	....	....	
1848	Toronto	C. W.	400,000	50	—		50,000	3 00	....	....	This Co. pay a quarterly div. of 2 per ct.

GAS-LIGHT COMPANIES IN CUBA, MEXICO, SOUTH AMERICA AND NEW ZEALAND.

When Chartered.	Town.	State.	Chartered Capital.	Par Val. per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
	Callao	Chile.		—	—	January & July.	20,000	7 00	....	....	
	Cardenas	Cuba.	50,000	—	—	Do.	180,000	5 00	....	....	
1857	Compania Cubana	Hav'a.	500,000	500	10	Do.			....	....	
	Cienfugos	Cuba.		—	—	Do.	12,000	5 00	....	....	These four towns are lighted by the Compania Cubana of Havana.
	Guanabacoa	Cuba.		—	—	Do.	14,000	5 50	....	....	
	Regla	Cuba.		—	—	Do.	10,000	5 00	....	....	
	Trinidad	Cuba.		—	—	Do.	16,000	5 00	....	....	
	Guinesa	Cuba.		—	—	Do.			....	....	
	Guyaquil	S. A.	150,000	—	—	Do.	25,000		....	175	
	Havana	Cuba.	2,000,000	500	—	Quarterly.	200,000	5 00	....		
	Lima	Peru.	100,000	—	—	January & July.	150,000		....	....	
	Maranham (Chartered)			—	—	Do.			....	....	
	Matanzas	Cuba.	50,000	—	—	Do.	180,000	8 50	....	....	
	Mexico City	Mex.	550,000	—	—	Do.			....	....	
	Montevideo	S. A.	500,000	—	—	Do.			....	....	
	Para (Chartered)			—	—	Do.			....	....	
18 4	Rio de Janeiro	S. A.	1,000,000	500	7½	Do.	800,000	4 00	....	....	
	San Iago	Chile.	500,000	—	—	Do.	180,000	7 00	....	....	
1857	Saint Jago de Cuba	Cuba.	450,000	500	—	Do.	25,000	5 00	....	....	
	Valparaiso	Chile.	500,000	—	—	Do.	85,000	6 00	....	....	
	Vera Cruz	Mex	500,000	—	—	Do.			....	....	
	Ville Clara	Cuba.	50,000	—	—	Do.			....	....	
	Auckland	N. Z.		—	—	Do.			....	....	

PAPERS ON HYDRAULIC ENGINEERING.

BY SAMUEL MCELROY, C. E.

No. 4.—City Sewerage.

[From the Journal of the Franklin Institute.]

(*Continued from page* 189.)

Ancient and Modern Practice.—The discussion of the general characteristics of the disposal of sewage, as to street dirt, house sewage, rainfall, analysis of sewage, value, utilization, and sanitary results, having been made, we may notice rapidly the former and more recent methods adopted for such disposal, as a commentary of example and precept; following in this respect the engineering law which always settles the *modus operandi*, from the premises of what is to be done, and what has been done.

Ancient Practice.—In the Eastern Hemisphere the excellence of construction which characterizes the palmy days of the Roman Empire may be taken as an example of former times. The authorities of Rome, clothed with great executive powers, magnified the calling of the engineers of the empire, and the engineers made the empire successful and glorious in public works, which testify to this day the science and art of their originators.

The examples of cities, harbors, roads, bridges, aqueducts, baths, sewers, and other works, which marked the progress of Roman conquest from Northern Europe to Africa, and from Spain, far beyond the Dardanelles, many of which are in use or in preservation at this day, furnish lessons and laws of construction, which are full of interest to the artificers of national works at the present day; and among the ruins of the ancient city itself are hidden vital elements of engineering success, though they are covered with the *debris* of intervening centuries.

The sanitary care of public health at Rome and in many of the provinces was exercised to a singular extent, as compared with modern life. No house was tenable without its water supply, and the quality of this supply was rigidly studied; among the wealthy classes, the utmost range of luxury in private fountains, baths, and other means of comfort was known, and the vast extent and costliness of public sanitary works make a prominent feature in the history of the empire. In founding cities careful attention was paid to the health of the residents in the vicinity, to the prevalent winds, the action of the atmosphere on building stone, and the facilities for urban and suburban drainage. In one case, at *Salopia*, an entire city was removed four miles to improve its healthfulness of location, by vote of the Roman Senate.

For the distributing towers or *castellæ* of the several aqueducts, the baths, the places of public amusement, as well as the dwellings and streets, the most ample and particular provision was made for drainage, by the use of channeled stone-work, pipes, and main sewers. The pipes were made of copper, lead, terra cotta, and earthenware, with a free use of hydraulic cement mortar, pear-shaped, square, and circular in form, with different kinds of joints; for the sewers, peperino stone, of volcanic origin, was much used, on account of its hardness; for the street entrances marble was used, as at the Forum. The drainage of various lakes and marshes was also accomplished by works of great magnitude and cost.

In the *Coliseum*, ample provision was made by sewers connected with the *Cloaca Maxima*, to carry off the surface rain and the supplies from the urinals and other public conveniences. The drain of the third corridor, 17 ins. wide by 36 deep, is lined with tiles and coated with cement, taking the discharge from upright pipes built in the upper walls; all the corridor drains connect with the sewers under the arena. Fifty six pipe drains, 12 inches in diameter, were provided for the third and fourth precincts, and all the mason-work of the sewers, which still remain, is of the most careful kind, to prevent leakage and smell. Equally studied details are found in the theatres and amphitheatres in other parts of the empire.

The *Cloaca Maxima* of Rome, said to have been built in the time of the kings, and now filled up by the obstructions in the Tiber, is about 14 feet wide by 32 feet high, arched over. It drained the Forum and the public dwellings. Another sewer of equal dimensions under the Cornitium and Forum was discovered in 1742, about 40 palms below the present surface. But the entire network of sewers of the ancient city, now buried under the accumulations of centuries, failing to act, the new city is deprived of their use, and proverbially unhealthy. Rome, modernized, presents a type of many modern sanitary works. The drainage of Lake Albano, undertaken 398 years before Christ, is one of the most remarkable works of the kind in existence.

The sewers of the Lazaretto at Genoa are supplied with a cleansing stream of water, conducted from the neighboring mountains, and carried through the court of the main edifice.

Earthenware pipes are found in the Egyptian tombs, in use as ventilators, and were used for other purposes in the prominent cities of that country. The use of concrete masonry in the pyramids, is an indication of the early application of hydraulic cement, which bears a most important part in the cisterns, aqueducts, sewers, and other hydraulic works of past and present ages; and the ruins of Carthage and Alexandria testify of the advanced state of these cities in sanitary works.

The public buildings, water-works, and sewers of *Agrigentum*, a Grecian colony, executed by Pheaces, 500 years before Christ, are recorded, as meriting special commendation, among the works of art in Sicily; while from the want of proper suburban drainage, *Pæstum* was abandoned by its inhabitants. *Aulis*, also a Grecian city, was celebrated for its manufacture of pottery. In the cities of Etruria, there are noted remains of arched passages which served as sewage outlets; some of these, as at *Tusculum*, show elaborate workmanship and ample proportions.

Recent explorations of the subterranean topography of *Jerusalem* have been made by Signor Pierotti, resulting in the confirmation of the history of Josephus, and a distinct tracing of the several ages of construction from Solomon to the Crusaders. A series of conduits and sewers from the site of the ancient Temple to the Brook Kedron, which admit an Arab walking erect, were discovered by him. Clay pipes have been found in the mines of the ancient city, of great thickness, which are supposed to have been connected with the pools of Hezekiah.

In remains of Roman works in use near *Zurich*, pipes of earthenware are laid, of short lengths and small diameter, delivering water under 200 feet head. The joints are made with large cubical blocks of concrete, in which the pipes are bedded and supported.

At *Nineveh*, drain pipes were found by Mr. Layard, leading from separate rooms of the dwellings, towards what was presumed to be a general system of sewers; this was also the case in Roman mansions, for which Vitruvius gives special directions.

The aqueducts and other public works of Chili, Mexico, Peru, and other parts of South America, many of which remain and are partially in use, give evidence of high rank in sanitary works, among the original occupants of this country. Baths and fountains were common in the houses of Yucatan in 1518. At *Tezcuco*, pipes were used as aqueducts from the mountains, and each house was thus supplied. "Moulded pipes, hard as stone," were used at *Churubusco* in the time of Cortez. The houses of the Incas of Peru are said to have been provided with bathing cisterns of gold, with drain pipes of the same metal; and silver pipes are also described as in use for domestic purposes. In all cases, and in connection with the elaborate construction of water-works, baths, and fountains, which abound in the examples of ancient history, the use of equally perfect means of drainage must be assumed, if not particularly mentioned, and devices sometimes considered modern are proved to be old; at *Herculaneum* the modern water-closet has been exhumed, and the ingenuity of ancient devices in water-machines for use and ornament is one of our lost arts. The descriptions of Cresy, Ewbank, and other collaborateurs, border on the fabulous, in hydraulic engineering.

The general and prominent lesson of this examination in things past, points out the great importance of sanitary works as subjects of governmental care and oversight, and the need of more definite and systematic engineering study. The province of the engineer in this direction is much more important than that of the physician. If the one is a corrective, the other should be a preventive, and both bear no ordinary share of the responsibility of human happiness and longevity.

The particular lesson conveyed in the examples presented, as to details of method, shows a disuse of cesspools and the importance of tubular sewers, as collaterals to trunk sewers. The Roman practice, in this respect, abounds in precepts and warnings. Their branch sewer-lines were small, very carefully jointed and lined, self-cleansing, and impermeable; these remain in use to the present time, while their immense, disproportioned structures are choked with deposit and valueless for present drainage.

We see that their sewerage was made direct from their houses and theatres to the sewers, without the use of cesspools, and that their intermediate sewers were narrow, and high, and carefully built in dressed masonry with cement lining. In some cases, rubble stone-work was lined with brick work, with inner cement plastering, which offered slight obstruction to flow and became very hard. Their engineers knew how to make cement mortar and believed in concrete; the same knowledge and faith would be of service in this generation; and their authorities trusted to the skill of the engineers, but public rulers and boards are wise in their own conceit, now-a-days, overmuch.

Modern Practice.—Among modern cities, *Paris* presents the most perfect administration of the cesspool system. Since 1819, these have been made impermeable, and either stationary in brick-work and masonry, or movable, in structures of wood. Their contents, from the regulations for use and cleaning, do not find their way into the main sewers, but are carted to the *voirie*, except in the case of some public buildings, and in some modification of practice, to be adopted with the re-arrangement of the sewer outlets for general interception. The office of the sewers is, therefore, to receive the rain-fall, part of the street dirt, and the kitchen and waste water of the houses, which enters the street gutters and flows thence into the sewer gullies. The change of plan will be made by the adoption of the tubular system, within or parallel with the main sewers; and large intercepting sewers are to be used for the protection of the Seine.

The sewers of the modern system are of nearly oval form for four sizes from 4.16 by 6.25 feet, to 7.58 by 9 feet; there are five sizes above these, varying from 7.83 by 9.5 feet to 16.41 by 13.41 feet high, which have waterways in the lower part, between double ledges, generally of 3.91 feet opening by 18 to 31 inches deep, with curved bottoms. The ledges are fitted with rails for the movement of cars, for sewer cleaning and other uses. Water-pipes are laid in the upper part of the section, gas-pipes being excluded on account of joint leakage. They are built chiefly of stone masonry, lined with cement plaster and whitewashed. Every morning and afternoon they are flushed 2½ hours from the hydrants. The cost, as given by Mr Chesbrough, ranges from $6 56 to $31 50 per foot.

Up to January 1, 1806, Paris had constructed, under the old monarchy, 23,300 metres of sewers; Napoleon built 4,804 metres, and the present extent is 226,600 metres, or about 141 miles.

The cholera of 1832 dictated the new system of construction and arrangement, and the entire character of underground Paris has been changed since then, or from 40,300 metres to 5½ times the extent. Much was also done under Brunescan to correct defects in grade, section, and line, which seriously interfered with the proper action of the old drains, some of which date back to 1412.

In the oval form of the smaller sizes, but more particularly in the *cuvette* or water-way at the lower part of the main sewers, and the daily use of street hydrants for flushing, the French engineers demonstrate the necessity, for ordinary water flow, of concentration in narrow channels for sewage. The inclinations of the smaller class vary from 1 in 1,000 to 1 in 400; for the larger class, from 1 in 2,000 to 1 in 1,000. The proper concentration of scouring water is not, however, fully realized, and much of the sewage matter is removed by hand.

The city of *Amsterdam* has the cesspool system, the liquid sewage of the houses and streets being drained into the canals. Great care is taken in separating and removing the ashes, the street garbage and sweepings, and the house sweepings, but the canals are offensive depositories of filth, and the health of the city is affected.

Berlin has but a short length of sewers, the street gutters being the common receptacle of that part of house sewage which does not enter the cesspools. The street gutters are flushed with water, and differences of opinion exist as to the purity of the atmosphere.

Hamburgh, since 1842, has abandoned the use of canals as drains, and adopted main sewers of brick-work, and the general use of water-closets in the houses, in connection with an improved supply of water by pumping engines. A portion of the city is drained by the use of dykes and a scoup-wheel engine, for residence and agricultural use.

Worthing and *Leicester*, in England, of 5,000 and 65,000 inhabitants, respectively, are illustrations of sewage delivery by pumping; at Worthing the same engine lifts the water supply 80 feet and the sewage 25 feet. It has a main brick sewer, with tubular feeders, 15 to 6 inches diameter. Water-closets are to supersede cesspools. At Leicester the sewage is pumped about 18 feet for ordinary flow. Brick sewers of circular form are used, varying from 12 to 54 inches diameter; depth, 12 feet. The sewage is deodorized and made into manure; in 1857, on a weekly lift of 22,000,000 gallons of sewage and lime-water, the loss in manufacture was 29 per cent. between cost and income.

Manchester, *Rugby*, *Croydon*, and *Edinburgh* are illustrations of the use of pipe-sewers.

Liverpool, *London*, *Glasgow*, *Carlisle*, and other cities have the combined system of pipes and large mains.

In our own country, *Chicago* and *Brooklyn* illustrate the general use of pipes, while *New York*, *Boston*, *Philadelphia* and other cities maintain large masonry sewers; and in many of our prominent cities the gradual abolition of cesspools may be considered a rule.

In many cases permeable drains have been constructed. This practice, as in vogue at *Albany*, we have had occasion recently to describe in a report to the Common Council, from which the following extract is made:

"It was customary at Albany, sixteen years ago, when I was connected with the city department, to build square drains (18 inches in the clear) on plank bottoms, with side walls of brick or stone laid dry, and with flag-stone coverings. Being penetrable, they readily wasted the water needed to scour out their solid contents; and were appropriated as runways for rats; for short districts, when made 18 inches square, they failed to operate as sewers, but became elongated cesspools; while, for long distances, their want of strength exposed them to constant damage from storm-flow. In a sanitary point of view, they were, therefore, exceedingly objectionable, and have proved the causes of great mortality, since the immediate and complete removal of house sewage is the only condition of public immunity and correct sewerage. In a business point of view, the damages to property by rats, and especially the damages by the contingencies of storm-flow to the sewers, to adjoining cellars, to street pavements, and otherwise, and the annual cost of cleaning and repairs, must have aggregated a heavy balance-sheet against them. This system, I understand, is still partially continued, but it must be from want of attention to facts apparent many years ago, and to the better practice of other localities."

Jersey City, which is comparatively low, with the Hudson in front and a salt marsh behind it, is also constructing some of its main sewers permeable. In the report of July 1, 1862, the engineer, Mr. Bacot, makes the followiug statement:

"The beneficial results already experienced from the building of three main sewers, with their laterals, in the Fourth Ward, as seen in the increased healthfulness of that section, and in the removal of the annoyances of flooded cellars and basements, amply compensate residents and owners of property assessed for their construction.

"In the construction of the main sewers, five courses of brick-work in the bottom arch of the sewer are laid dry, or without cement, allowing a constant drainage of the subsoil, the effect of which, in drying up the street and surrounding property, is manifest for a considerable distance on either side of the sewer."

There may be local circumstances which justify permeable sewers, by subsoil saturation from springs or other sources, independent of local rainfall. Here the benefits are limited in depth to the flow-line of the drains, and wherever the external head does not exceed this, the action of the sewer is, to a certain extent, vitiated. Water should not be lost from a sewer laterally. Flushing by tidal action is relied upon in this city for the main sewers. The laterals are pipes.

Of 116½ miles of sewers built in *New York*, from 1849 to 1863, the smallest size is an ellipse, 48 inches by 32. Under the head of repairing and cleaning, the expenditure for 1860 was $45,921 on 107 miles. The minimum size provides for the entrance of laborers. During the present year, oval pipes 29 by 19 inches, of hydraulic cement, have been introduced to a limited extent, and an effort is being made by Chief Engineer Craven to improve the general plan of city sewerage.

London, which ranks all other cities in population, has also the greatest extent of sewerage. Up to June, 1855, the metropolitan area contained 658 miles of brick sewers which had been explored, with 150 miles approxmiately unexplored, and 126 miles of pipe-sewers, or a total of 934 miles, covered, with an approximate length in open sewers of 400 miles, or 1,334 miles in all—nearly ten times the length in Paris, and about thirteen times the length in New York.

The area covered by the eight western, five northern, eight central, and six eastern districts on the north side of the Thames, and the twelve districts on the south side, is about 118 square miles. This includes the valley of the Thames from Brentford to Richmond, with the lateral valleys of three streams on the south side. In 1855 the Metropolitan District was organized under the "Metropolitan Board of Works."

Some of these sewers are supposed to be of Roman origin. A large number are uncovered, and those which have been built in, more particularly since 1756, being made to suit the special localities and emergencies, without regard to a general system, present a most singular combination of lines, sections, and grades, and a curious illustration of the transition state in city sewerage, to which Victor Hugo's description of the entrails of Paris applies with great force.

Sewers in some cases commencing with a section 5 feet by 2.5 contract to 3.25 feet by 2, expand to 5.5 feet by 3, and with other changes, among which are reversed grades, have an outlet section of 3.25 feet by 2.25. Others are built of enormous proportions, which prevent concentration of ordinary water-flow on their solid contents, and form deposits which produce reactions in time of storm-flow. Their lines of feeders being arteries instead of veins subject them to a water impact often fatal to their strength, at points where deposits reduce their water-way. The size of "*small sewers*," established by ordinance of the Westminster Board, Dec. 17, 1824, was a section 5 feet high by 2.5 wide, with arched top and bottom and straight sides, to have "a current of not less than one-eighth of an inch to each foot in length," or 1 in 96.

The Finsbury sewer at the outlet is 6.5 feet by 4.5; the Irongate sewer averages 8 feet by 3.66; the London Bridge sewer has an outlet of 8.25 feet by 6.75; the London Wall sewer, 10 feet by 8; and the Fleet sewer, 18.5 by 12; these are some of the enormous mouths of the London cloaca, convenient channels of pestilent internal air currents.

The intercepting sewers recommended by the Commission of 1857 were to have a channel on the north side of 39 feet broad by 16.5 feet deep, and on the south side 37 feet by 16, with a grade of 6 inches per mile, with an outfall on the Thames, about 23 miles from the point of interception. These were calculated for a flow of 2.5 feet per second. The estimate of cost was £5,654,755. The total movement of sewage and rainfall from the metropolis was taken at 185,669,993 cubic per day, or 1,160,312,456 gallons, being about twice the flow of the Thames, which runs from 500,000,000 to 600,000,000 gallons.

In contrast with this system of arteries, the veins or pipes introduced in 1848 have been working their way against adverse currents, and with many curious results. In place of court and alley drains, 3 feet by 2.16, or generally 4 feet by 2.33, 6-inch pipes have been used to drain 150 houses; 12-inch pipes, placed within sewers 5.5 feet by 3.5, have more successfully drained their district of 44 acres; and 15-inch pipes have relieved sewers 5 feet by three, otherwise accumulating deposit from 1,200 houses, at 6,000 cubic yards per month. It has been shown that these veins could be supplied to certain districts for the capital which represented the annual cost of flushing the original drains.

In its recent adoption of a system over 2,000 years old, which theory advises and practice demonstrates; in its illustrations of cumbrous and expensive devices; in its fearful chapters of mortality; in its long-continued compilation of tests, analyses, plans, arguments, and commissions; in its admirable custom of publication, its extravagant outlay, and in various other respects, the history of London Sewerage is one of the most interesting and instructive lessons which can claim the attention of the engineer.

The sewerage plan of *Brooklyn* was arranged by its engineer, J. W. Adams, C. E., in 1858, under very favorable circumstances, as the common use of cesspools and the delay in the introduction of water, had not required much previous construction of sewers to interfere with a correct plan.

With trunk mains, adjusted to its several water slopes, the city was districted for a general use of intermediate pipe drains. The relative proportion in length of sewers, under this plan, so far as built or actually under contract since 1858, will appear from the following schedule:

TRUNK MAINS.

72	inches diameter	2,472	feet.
60	" "	6,099	"
54	" "	1,425	"
48	" "	15,405	"
42	" "	662	"
36	" "	21,282	"
Total		47,345	"

TUBULAR SYSTEM.

24	inches diameter	34,123	feet.
18	" "	59,102	"
15	" "	112,049	"
12	" "	310,104	"
Total		515,378	"
Grand Total		562,723	"

The appurtenances number 2,116 street basins and 5,403 man-holes.

Contrary to the usual practice of large cities, not more than eight and a half per cent. of the Brooklyn sewerage in length is classified under the head of trunk sewers, or those which can be entered and cleaned by laborers, the system being considered self-cleansing; three-fifths are 12 inches in diameter, one-fifth 15 inches, and one-tenth 18 inches. Their operation has fulfilled the most sanguine expectations.

The Board of Works in Chicago, several years ago, sent their Chief Engineer, E. S. Chesbrough, Esq., to Europe, to examine foreign practice as a guide for his general plan of sewerage. On his return, and by his advice, the tubular system was adopted and put under construction, under conditions calculated to test its efficiency severely. But all his subsequent reports confirm the correctness of his advice and sustain European experience in this respect.

We see, then, in contrasting ancient and modern practice, that the former was systematic and that the latter is chaotic. The ancients discarded the malignant and abominable cesspool system which with us is in universal custom; they not only drained public and private buildings, with great care to obtain "adequate and prompt disposal" of sewage, but in many cases each room in a house was separately drained.

Their use of pipes of various manufacture, and in many cases of superior quality to present examples, shows a full appreciation of the benefits of this system, though their lavish use of flushing streams seems to have controlled the plans of main sewers. In respect therefore to ordinary sewage flow, as self-operative, modern practice has developed, at a late day, and to a limited extent, some improvement; but this improvement is yet in its transition state, while the entire history of modern practice shows a want of educated supervision and a general defect in operation, which places it far below the "things that were," both in Europe and America, and by no means to the credit of our standard of civilization.

GLEN'S FALLS, N. Y.—At a meeting of the directors of the Glen's Falls Gas-Light Company, held at their office December 26, 1863, a semi-annual dividend of 3 per cent. on the capital stock of said company, free from Government Tax, was declared, payable on and after the 15th inst.

THE AMERICAN GAS-LIGHT JOURNAL is published on the 1st and 15th of every month, and is the recognized official organ of

LIGHT, HEAT, WATER-SUPPLY AND SEWERAGE.

Its purpose is to ascertain and make known all new discoveries in the science and economical application of LIGHT, and promote thereby the interests of companies and consumers; to encourage and aid the introduction of PURE WATER from Lakes and Rivers into TOWNS and Cities, and to improve the system of SEWERAGE, VENTILATION, HEATING, and DRAINAGE everywhere.

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SUBSCRIPTION—In the U. S. and British Provinces, $3 per annum. In Great Britain, 12s. per annum, payable in British post-office orders, remitted to the Editor, addressed as below.

ADVERTISEMENTS—According to position and space occupied.

☞ Remittances by mail to be addressed to the Editor,

C. ELTON BUCK,

ROOMS of the AMERICAN GAS-LIGHT JOURNAL,

No. 39 Nassau st., cor. of Liberty st., opposite the Post-Office.

New York City

AGENTS OF THE AMERICAN GAS-LIGHT JOURNAL

FOREIGN.

Germany .....B. WESTERMAN & Co., of New York.

Great Britain....TRUBNER & Co., 60 Paternoster Row, London, where single copies may always be found,

Paris, France. ..} LE JOURNAL DE L'ECLAIRAGE AU GAZ, 25 Boulevard Poissonnière.

DOMESTIC.

V. HAROLD MYERS, No. 152 South Fourth st., Philadelphia.

The AMERICAN GAS-LIGHT JOURNAL can be purchased of all the newspaper and periodical dealers in the U. States and Canadas.

THE

AMERICAN GAS-LIGHT JOURNAL,

PUBLISHED ON 1ST AND 15TH OF EVERY MONTH.

C. ELTON BUCK, ... EDITOR.

FRIDAY, JANUARY 15, 1864.

A retrospect of the year which has recently passed away affords no striking subject for discussion, nor recalls any particular items of interest to the gas-world of America. The old year witnessed the birth of but few new companies, and it is quite probable that, in consequence of the war, with its attendant enhanced prices of materials and labor, the new year will not surpass its predecessor in the number of companies inaugurated. Indeed, in such an unfortunate state as the country is now in, the friends of gas-light enterprises may congratulate themselves that there has been no retrogression, and that even the few new works which have been built have been started on so sound and satisfactory foundations. Perhaps the expression "unfortunate state" may need some qualification. Unfortunate, indeed, it is, in more senses than one. The existence of war—civil war particularly, where brother stands arrayed against brother—is ever deplorable; but in some senses, those parts of the country loyal to their government and institutions were never in a more prosperous condition. Never were our manufactories so overflowing with orders. Never has it been so difficult to get work done, from the simplest labor of the unskilled operative, to the more delicate and expensive workmanship of the mechanic and artisan. Never have steam-engines and machinery of all descriptions been in such great demand, and never before in the history of the land have employers paid such exorbitant wages to laborers of all kinds. Amid all this excitement and hurry of business, it is almost impossible to obtain estimates for castings, retorts, and other appliances necessary in the construction of gas-works. Besides this, the cost of building works has advanced in such a ratio as to deter many engineers from entering into new enterprises until the return of more auspicious times. The margin of profit which the builder of gas-works would expect would be very materially reduced, and as the price of raw materials used in the manufacture of gas has advanced in an equal ratio with that of the building materials, there is a like drawback on this score Consumers would never appreciate or understand the reason of these difficulties, and consequently an increase in the rates of gas to compensate for the increased cost and expenses of making gas would not be quietly submitted to; or the people expected to become consumers would be very likely to abstain from the use of gas, and adhere to their oils and candles.

Until prices of all commodities get back to their normal figures—or, in other words, until a resumption of specie payments is reached—we cannot hope for the construction of many new gas-works. It is true, some will be built, and they will prove profitable investments to their owners; but we cannot help thinking that the war will retard development of the gas-light interest of the country to a greater extent than any branch of industry.

From all that we have heard, the gas-works in the Rebel States must be in a very sickly condition. The almost total deficiency of the South in foundries, and the isolation of the insurgent country from the rest of the world, have rendered it almost impossible for them to replenish their worn-out stock of apparatus. The few foundries in existence in that section of the country have been kept busy in casting ordnance and doing other work for their bastard government, while the stringency of the blockade has prevented the introduction of articles of foreign manufacture. Among the captures made by our navy off one of the Atlantic ports was a complete set of iron retorts, hydraulic main, &c., intended for one of the rebel cities—perhaps the Charleston gas-works These articles are now probably doing duty in works rather nearer MASON and DIXON'S line than their maker intended.

Among other items which we have from time to time given to our readers, have been announcements of advances in the price of gas in various parts of the country. In addition to these advances, a number of companies have found it necessary to add the excise tax to their bills, which they had previously assumed. Consumers have generally acquiesced in these increased prices, perhaps after indulging in the customary grumbling, which they, as a class, are prone to do.

In England, the progress of gas-lighting has been more marked during the past twelvemonth than here. A large number of new works have been built, and, as we learn from the *Sanitary Reporter*—the only reliable gas journal in Great Britain—the price of gas has been reduced by upwards of thirty companies The operations of most of the companies are said to have been attended with unexampled prosperity, and the dividends have exhibited a progressive increase. It is suggested by our contemporary that in future legislation for the establishment of gas companies, a sliding-scale be adopted, "whereby the dividends may be increased in the inverse ratio of the price of gas, so that consumers and gas companies may both derive benefit from the operation of the same causes, and be combined, as it were, in a sort of partnership.

One of the most important subjects agitated in the technical journals of England has been that of the supply of the public lamps by meter. This subject, the importance of which will strike all thorough engineers, has elicited a warm discussion, and has drawn forth the opinions of many well-known writers on gas, both for and against it. J. O. N. RUTTER, Esq., of Black Rock, Brighton, who has probably done more than any other writer to popularize the use of gas, is decidedly in favor of meters on public lamps; while SAMUEL HUGHES, Esq., and other celebrated experts, are no less ardent in their advocacy of the reform. We have given extracts from the leading journals on this subject, and shall continue to reproduce in our columns whatever may prove interesting to our readers. Despite the endeavors of a so-called organ of the gas companies in London to ridicule the measure, it is steadily gaining ground, and we hope ere long to be able to announce that the contract system has given way, in some places at least, to the far more equitable method of supplying public lamps by meter, precisely as private consumers are furnished with the gas they burn. The average meter system has been already adopted in Reading and other English towns, and, as it seems to have given satisfaction, it will soon spread and become more widely known.

The Metropolitan Board of Works of London intend to apply to Parliament at the coming session, for the passage of an act whereby they may be empowered to compel gas and water companies to lay their mains in the subways which have been constructed under several of the streets of the metropolis. It is said that the London gas and water companies will strongly oppose the bill. An English paper, speaking of this project, says:

"The experience hitherto gained in the use of subways for the purpose of laying gas-pipes has been far from satisfactory. The longest subway in the metropolis extends under the new street in Southwark, and is about a mile long. The Phœnix Company laid a service-main in it for the supply of the contiguous houses, but much difficulty and danger have been experienced in the introduction of gas-pipes within so confined a space. One explosion occurred in that subway by which a workman lost his life, and another man was very severely injured; and, in the shorter subways near Covent Garden and at Clerkenwell, there have been serious accidents, the explosive mixture of gas with which they were filled having been ignited by lighted lucifers carelessly thrown down gully-holes. In such a dangerous atmosphere the men are obliged to use safety-lamps, and, with the imperfect light thus obtained, it is impossible to do the work properly. The unavoidable escape of gas in tapping the mains also renders the men faint, and physically incapable of working efficiently. The leakage arising from imperfect joints added to the accidents to which the exposed pipes are liable, must render the subways frequently as dangerous as the most fiery coal mine, and there would be a constant liability to explosion by contact with the artificial lights used in laying pipes and in making alterations."

All of which may be true, or it may not. The journal publishing these lucubations is notorious for opposing all reforms, no matter how much needed they may be. When the subway plan was first suggested it received the encomiums of many of the first engineers, and one of the chief recommendations they mentioned was, that it would be far easier to prevent leakage by having the mains in a receptacle where they could be frequently examined, and kept tight as the ordinary fittings in a house. The Metropolitan Board of Works would hardly advocate the exclusive use of subways if the objections above mentioned prove valid. The discussions on this subject will doubtless call forth much interesting evidence on both sides of the question, and the opinions of many experts will be sought.

DEATH OF WM. D. PARRISH, ESQ.—It is with much regret that we announce the death of Wm D. PARRISH, Esq., who expired at his residence in Philadelphia, on Christmas morning, after a short but severe illness. Mr. PARRISH was widely known to gas engineers, having been identified with the construction of several gas-works in different parts of the country. To his many friends his death will prove a severe loss, for he was much esteemed, and had a large circle of acquaintances. When we last had the pleasure of seeing Mr. PARRISH he was apparently in the enjoyment of excellent health, and the news of his decease was most unexpected.

GAS ENGINEER'S ALMANAC FOR 1864.—We have received a copy of the Gas Engineer's and Superintendent's Almanac for 1864, published by the American Meter Company. This little volume is indispensable to every gas engineer. Besides containing tables of the days of the year, with blanks to be filled up with the record of each day's operations, it gives directions for calculating the time of lighting and extinguishing the public lamps, and is likewise filled with figures of the utmost importance to all engaged in the manufacture of gas. It is wonderful that so great an amount of information could be crowded into so compact a space. The tables of circumferences and areas of circles, of squares, cubes, square and cube roots of numbers, of sines and co-sines, tangents, &c., &c., will be found to save a vast amount of figuring, while the rules relating to mensuration will be invaluable to every engineer. We cannot pretend to give a tithe of the useful information so compactly squeezed into this little book, but we will content ourselves with saying that no engineer ought to be without it.

TO OFFICERS OF GAS COMPANIES.

The following letter from a loyal Union refugee from rebel barbarity we commend to the attention of the officers and directors of gas companies throughout the country. Mr. Horton, the writer, has had much experience in the practical management of gas-works, and can produce the most satisfactory testimonials from his late employers and others. His trials and sufferings, arising from his devotion to the cause of the Union, and the appalling calamity which befel him in the death of his wife, are enough to engage the sympathies of all, and we trust that it will not be long ere he is enabled to obtain such a situation as he desires.

Williamsport, Pa., December 29th, 1863.

To the Editor of the American Gas-Light Journal:

I arrived here at this place in September last, after being four years superintendent of gas-works at Staunton, Va., for Messrs. Waterhouse & Bowes, lessees and builders of the above works. I went to Virginia in August, 1859, under an engagement for five years, but owing to the troubles between North and South—the war—and I coming from the North, caused me considerable abuse from the citizens of Staunton, and mostly my gas consumers. I consulted my employers, Waterhouse & Bowes, and resigned in August last, in order to get back to the North, after selling all my effects by public auction, on 7th and 8th September last. I left Virginia with my wife and family on 13th September, travelling through the valley of Virginia, and reached Baltimore city in safety. But, alas, what a calamity overtook me! We left Baltimore by quarter past nine o'clock night express, for Williamsport, Pa., on 19th September, and on the 20th, next morning, Sunday, the train ran off the track, instantly killing my dear wife. The babe, seven months old, was found clasped within its mother's arms, unhurt, except a few slight bruises on its forehead. I was much injured, having two of my ribs broken, and two of my children were also injured, but not seriously. I thank God I am myself, and also my family, recovered.

I have, since my stay here in this place, been speaking to several gentlemen, who strongly recommend me to advertise in your Gas-Light Journal for superintendent of gas-works. I can give every satisfaction as regards experience, having been in the gas business upwards of twenty years. Please write me on this subject, and oblige

Yours most truly,

R. V. Horton,

Late Supt. of Gas-works, Staunton, Va.

Mr. Horton's address is Williamsport, Lycoming County, Pa. Any communications designed for him may be sent to our rooms, whence they will be at once forwarded to him.

Watch Presentation.—On New Years morning, the employees of the New York Gas Company presented to Mr. Charles C. Mowton, their Assistant Superintendent, at his residence, a magnificent gold chronometer watch and chain, valued at $500. Mr. Mowton, by his urbanity and gentlemanly bearing, has won the esteem of his workmen, who took this method of manifesting their appreciation of his many good qualities.

ANSWERS TO CORRESPONDENTS.

J. H., of N. Y.—*The companies do not keep up a sufficient pressure on their mains during the day. At night you will have a much better flame.*

C. C. B., of N. H.—*Your queries will have to remain unanswered for the present. In the meantime you will find much information in Hughes and Clegg, to which we refer you.*

E. L. C., of Ky.—*We believe the information given in our tables to be correct. They were compiled at a great outlay of labor and money, and save a few errors where changes have been made by the companies, they will be found reliable—far more so than any in the census returns, the inaccuracy of which we showed up some time ago.*

R. C. D., of Ind.—*Dry meters are far more extensively used than wet, and it would not be surprising if the latter were soon altogether replaced by the former. For accuracy, we are old fashioned enough to prefer wet meters.*

A. L. B., of Pa.—*We have received the report, for which accept our acknowledgments. It is very creditably prepared, and presents a good deal of interesting information.*

L. P. G., of Me.—*It will be published in a few weeks.*

THE EARLY WATER SUPPLY OF LONDON.

In the year 1236 we first hear of artificial water supply in the metropolis. In 1285, the conduit in Cheapside, which had been fifty years in building, was completed. This was castellated with stone and cisterned with lead, and was situate at the east end of Cheap, at the junction with Bucklersbury, opposite Mercers' Hall, then the hospital of St. Thomas d'Acona.

The following seems to be the best list which can be obtained showing the date of the erection of the other London conduits:

A. D. 1401, the "Tun" in Cornhill, so called from a prison of that name adjacent. It was originally a spring, but at the above date was made a cistern of sweet water conveyed in pipes from Tyburn.

A. D. 1423, Billingsgate Conduit, opposite the market, where Sir Richard Whittington built a reservoir for the use of the market people. This can be scarcely called a conduit, but a spring running from a "boss" in Boss-alley, so named therefrom. A spring which formed part of this water supply may still be seen, together with portions of a Roman residence, in the basement of the present Coal Exchange.

A. D. 1423, Cripplegate Conduit, St. Giles's Churchyard. Here Sir Richard Whittington made a "boss of clear water" in the walls of the churchyard; and in 1438 Sir William Eastfield brought water here from Highbury. Near this was a spring called Crowder's Well.

In 1433, the priors and canons of St. Bartholomew's in Smithfield, constructed a conduit for the supply of the monastery, bringing the water from their estate at Canonbury.

A. D. 1438, Fleet street conduit, opposite Shoe-lane, built by Sir William Eastfield, lord mayor this year. This conduit was supplied from Paddington. Stow says that this had a fair tower of stone, was garnished with images of St. Christopher, &c., "with sweet-sounding bells before them, whereupon, by an engine placed in the towers, they, divers hours of the day and night, chimed such a hymn as was appointed."

Aldermanbury Conduit, opposite the south side of St. Mary's Church. This was also erected under the will of Sir W. Eastfield; was destroyed by the Great Fire, and rebuilt; but was removed early in the eighteenth century.

A. D. 1478, Fleet Bridge Conduit, at the foot of the bridge over the Fleet river. This was erected to receive the overflow of the conduit opposite Shoe-lane.

A. D. 1491, Gracechurch street Conduit, nearly midway between Fenchurch street and Eastcheap.

A. D. 1498, Holborn Conduit, at the foot of Snow-hill. This was rebuilt by William Lamb—the founder of Lamb's Chapel, near Cripplegate—a citizen and member of the Clothworkers' Company, in 1577, at a cost of £1,500. The conduit was supplied from a head near the Foundling Hospital, on the east side of Lamb's Conduit street, close to where the "Lamb Tavern" now stands.

A. D. 1500, Stock's Market Conduit, at the Lombard street corner of the site of the present Mansion House. After its destruction by the Great Fire, the conduit was rebuilt at the cost of Sir Robert Viner, lord mayor.

A. D. 1505, Bishopsgate Conduit, at the junction of the Wards Within and Without.

A. D. 1528, Coleman street Conduit, at the junction with London ward.

A. D. 1535, Aldgate Conduit, on the site of the present Aldgate Pump. This was originally a well called St. Michael's, converted into a conduit with sweet water from Hackney. This conduit was also destroyed at the Great Fire, and the cost of regaining the water, and putting the place into order, is charged at £452 15s. 10d. In this instance, as in many others, the conduit seems to have been erected on some well-known spring or other water supply. The water which has supplied the draughts at Aldgate Pump is from the ancient spring. Many will not be sorry that those city draughts are no longer available.

Lothbury Conduit, at the west end of St. Margaret's Church.

A. D. 1568, Dowgate Conduit, opposite Skinner's Hall, first erected in 1508. Stow says that there was in his day recently erected an engine to convey Thames water into Dowgate Conduit. In 1574, the channel from this conduit was so swollen by a storm of rain, that a youth of eighteen was carried by it into the Thames, and was lost in spite of all endeavors.

A. D. 1582, the Cornhill Standard, at the junction of Cornhill with Gracechurch, Leadenhall, and Bishopsgate streets. This was erected by Peter Maurise, a Dutchman, who conveyed Thames water over the steeple of St. Magnus, London Bridge, by an "artificial forcier," to the northwest corner of London-wall, whence it flowed to the Standard, and poured out by four mouths opposite the respective streets. This water supply ran only during the ebb tide, and became at times a nuisance by reason of its flooding the streets. Pepys refers in his Diary to this conduit eighty years after its erection. It was reduced to ruins by the Great Fire of 1666, and does not seem to have been replaced.

A. D. 1610, Aldersgate Conduit, without the gate; the precise spot not known.

Soper-lane Conduit: the date of its erection uncertain; and the same may be said of the conduit on Old Fish-street-hill. This latter was, however, cisterned with lead, and castellated with stone, for receiving Thames water.

From the above notes, we may infer that, during the Roman occupation of London, there was a sufficient supply of wholesome water from springs and rivulets, so that the works being unnecessary, we find here no traces of those magnificent aqueducts which are to be met with in various parts of the Continent of Europe. Up to 1236, the natural water supplies seem to have been the only means of providing water for the domestic use of the Londoners. Then, from the beginning and towards the end of the fifteenth century, it became needful, in consequence of the increased population, to procure water from other sources. Afterwards the Dutchman's water supply and Sir Hugh Myddelton's New River water were obtained; and now, although several great water companies have been formed on both sides of the Thames, the cry still comes for the increased and more pure supply of this important element of human life. We are not without hope that before the reign of Queen Victoria has ended, we shall have a proper system organized for the supply of this vast city.—*London Builder.*

New Gas Material.—At a stated meeting of the Franklin Institute, held in Philadelphia November 19th, Professor Fleury exhibited samples of a new artificial fuel and gas material, the invention of Mr. William Gerhardt. This invention consists in preparing porous bricks, balls, or otherwise shaped fireproof material, which are fully saturated with gas-tar, coal-oil, or any other hydrocarbon of a similar nature. These bricks are afterwards dried, and used for the purpose of producing illuminating gas or fuel. The oil having burnt out, the material is used over again; it leaves no ashes, and preserves its porosity. The use of fuel that is free from sulphur is of the highest importance in the manufacture of steel, iron, glass, &c., and it is claimed that this artificial fuel is well adapted for these purposes, as well as for other uses, because the price of manufacture is not so high as the present price of coal.

Washington, D. C.—A strong effort is being made to organize an opposition gas company in the city of Washington. This place, although a "city of magnificent distances," is not too large to be lighted by one company, and the inauguration of a second will be but the beginning of a series of squabbles, by which consumers will be harmed rather than benefited.

Gas in Brazil.—The gas-light company of Rio de Janeiro, Brazil, is said to be in a most prosperous condition, and to maintain the high position among well-managed companies which it took several years ago. The company pay large dividends, and the shares command a premium of over 50 per cent.

A Step Backward.—It is said that the public lamps of the city of Quebec, Canada East, are to be lighted with Kerosene oil instead of gas. In this age of progress, the substitution of oil for gas is a decided backward movement, and does not argue well for the development of modern improvements in that part of John Bull's dominions.

GAS BURNERS.

In referring to the various kinds of burners used for coal gas, it must be remarked that the photogenic power of any luminiferous agent depends upon two conditions—*quantity* and *intensity*. By *quantity*, I mean that the carbonaceous particles of the flame are numerous; by *intensity*, that they are highly heated. Now, the perfection of gas illumination consists in providing a burner, so constructed that these two conditions just balance each other. This subject appears to be very little understood by many burner-makers. In fact, in some experiments made recently on 15-hole Argand burners, obtained from different establishments, I have found the illuminating power of 5 feet of gas to vary as much as fifty per cent., simply through the above conditions not being properly attended to. The oxyhydrogen lime-light is an excellent example of *intensity*, the number of particles of carbon being very small, but the temperature to which they are heated very high. The *quantity* of light from a solid wick oil-lamp is great, but the *intensity* is small. So that there may be great *intensity* where the *quantity* is small, or great *quantity* where *intensity* is small. If a straight wire be passed through the flame of a common candle, there will be no increase of illuminating power, because the flame of the candle already contains more solid constituents than can be satisfactorily heated by the hydrogen of the tallow; whereas, with Newcastle gas, burning from an ordinary batwing or fishtail burner, exactly the reverse is the case, because the hydrogen is in excess, and the solid matter deficient. Now, if the color of the flame from a well-constructed Argand burner be compared with that from a fishtail or batwing, it will be observed that the former is brown and the latter blue, which clearly shows that the quantity of light exceeds the intensity in the Argand, whereas with the batwing or fishtail the intensity exceeds the quantity.

If the light produced from 5 feet of gas consumed in a 15-hole Argand burner be equal to 13 candles, the light from a similar quantity of gas, consumed in a batwing or fishtail burner, will not exceed 9 candles; and the reason the batwing burner gives so bad a result, when compared with the Argand, is because there is too great a contact with the atmospheric oxygen in the lower part of the flame of the batwing; and this is easily proved by causing two flames, from batwing or fishtail burners, to impinge upon one another, and thus reduce the surface in contact with the atmosphere by nearly one-half; for, by such an arrangement as this, 5 feet of gas, consumed in a double batwing burner, gives the same amount of light as 5 feet consumed in a 15-hole Argand of the best construction. And, guided by these observations, I think it follows that every burner has a certain fixed amount of gas which it will consume with the greatest photogenic advantage, and that when the gas is issuing from the burner at so low a pressure that the flame is just upon the point of smoking, the maximum effect for the quantity of gas consumed in that particular burner is obtained, because, in this case, the quantity and intensity of the light are so advantageously balanced, that the greatest illuminating power is the result. And, by the same reasoning, I think it also follows, that the burner best suited for the combustion of coal gas, is one in which the openings are large, so as to prevent, as much as possible, too great contact with the air in the lower part of the flame—an evil to be carefully avoided, for every one knows that an Argand burner, consuming 5 feet of gas, does not give so much light with a 9-inch chimney as with a 7 inch, because, with the former, there is a much larger supply of air than with the latter.

The laws which govern the discharge of gas through small orifices are exceedingly simple, and depend upon the specific gravity of the gas, and the pressure under which it is discharged.

The quantity of gas of the specific gravity of ·413 discharged through a $\frac{3}{8}$ jet, under the following pressures, was as the result stated below:

Pressure.	Gas consumed per Hour.	Pressure.	Gas consumed per Hour.
15 tenths.	31·0 feet.	3 tenths.	13·5 feet.
10 "	26·0 "	2 "	11·8 "
5 "	17·5 "	1 "	7·8 "
4 "	16·3 "		

Now taking the standard quantity as 31 feet discharged, under 15-tenths pressure, and calculating the quantity discharged under any other pressure as the square root of that pressure, we get the following results:—

Pressure.	Gas consumed per Hour by Experiment.	Gas consumed per Hour by Calculation.
15 tenths.	31·0 feet.	
10 "	26·0 "	25·3 feet.
5 "	17·5 "	17·8 "
4 "	16·3 "	16·02 "
3 "	13.5 "	13·8 "
2 "	11·8 "	11·4 "
1 "	7.8 "	8·0 "

Hence, it appears that the number of cubic feet of gas discharged through a small orifice,* under various pressures, is as the square root of these pressures. Similarly, it may be shown that the quantity of gas discharged through a given orifice, under the same pressures, is as the square root of its specific gravity. This is established pretty clearly by filling an ordinary 10-feet gasholder with gases of different densities, and allowing them to blow off under similar pressures. If the time is carefully noted, the truth of the above statement can be easily verified. The following results have been obtained from an experiment made in this manner:

	Quantity Discharged.	Specific Gravity.	Time by Observation.	Time by Calculation.
Air	10 feet.	1·000	195 seconds.	..
Cannel Gas...	10 "	580	145 "	148 seconds.
Common Gas..	10 "	419	120 "	126 "

The barometer at the time was 30·2 inches, and the temperature of the air 50°. The figures in the second column were, of course, corrected to the standard temperature of 60°, and barometric pressure of 30 inches.

In order to make this subject more clear, and to show that the remarks I have made are founded upon the results of actual experiment, I subjoin the following tables, which I think prove satisfactorily the correctness of the observations I have made upon this part of the subject.

The following experiments were made in 1860, with common batwing burners, Nos. 3, 4, 5, and 6. The gas, at the time tested with a 15-hole Argand burner, 7-inch chimney, consuming 5 feet per hour, gave a light equal to 14 standard candles.

Pressure.	Burner.	Quantity consumed, in Feet.	Illuminating power, in candles.	Reduced to 5 ft. per hour.	Value of 1 ft. of Gas in Standard Candles.
25 tenths.	No. 3 Batwing.	5·5	6	5·45	1·09
20 "	"	5·0	6	6·0	1·2
15 "	"	4·0	5·2	6.5	1·3
10 "	"	3·2	5·1	8·0	1·6
5 "	"	2·0	4·2	10.5	2·1
25 tenths.	No. 4 Batwing.	7·6	9·0	5·9	1·18
20 "	"	6·6	9·0	6·8	1·36
15 "	"	5·5	8·0	7·2	1·45
10 "	"	4·1	6·75	8·2	1·64
5 "	"	2·8	5·0	8·9	1·78
25 tenths.	No. 5 Batwing.	7·2	10 5	6·6	1·32
20 "	"	6 7	10·5	7·8	1·56
15 "	"	5·4	9 6	8 8	1 75
10 "	"	4·5	8·5	9·4	1·88
5 "	"	2·6	6·0	11·5	2·30
25 tenths.	No. 6 Batwing.	12·5	9·75	3·90	0·78
20 "	"	11·0	13·5	6·13	1·22
15 "	"	9 5	12·5	6·57	1·31
10 "	"	7·8	11·0	7·05	1·41
5 "	"	5·0	9·0	9·00	1 80
2½ "	"	3·0	5·5	9·17	1·83

The slits in the burners, Nos. 3, 4, and 5, were now slightly enlarged, by passing a saw through them, when the following results were obtained:

Pressure.	Burner with enlarged slit.	Quantity consumed, in Feet.	Illuminating power, in candles.	Reduced to 5 feet per hour.	Value of 1 foot of Gas in Standard Candles.
25 tenths.	No. 3 Batwing.	9·4	12 0	6·38	1·27
20 "	"	7·3	12 0	8·19	1·64
15 "	"	6·5	11·0	8·46	1·70
10 "	"	5·0	9 0	9 00	1·80
5 "	"	3 6	9·5	9·03	1·80
25 tenths.	No. 4 Batwing,	9·0	10·5	5 83	1·16
20 "	"	7·8	10·5	6·73	1·34
15 "	"	6·5	10 0	7·69	1·54
10 "	"	5 0	9·5	9·50	1·90
5 "	"	3·0	7 0	11·66	2·33
25 tenths.	No. 5 Batwing.	9·5	12·5	6·58	1·31
20 "	"	8·1	12·5	7·71	1·54
15 "	"	6·9	11·5	8·33	1·66
10 "	"	6·0	10 0	8·33	1·66
5 "	"	3·6	7·0	9·72	1·94

From an inspection of these tables, it appears that in each case when the gas was issuing with the lowest pressure, that is, when there was the least atmospheric contact with the lower part of the flame, the photogenic power was greatest; and when the gas was issuing under the heaviest pressure, and there was consequently the greatest atmospheric contact, the photogenic power was least.† This appears very conclusively in the sixth column, where, opposite five-tenths pressure in each table, it will be seen that the value of one foot of gas in standard candles far exceeds that of the same quantity of gas consumed under higher pressure.

It has been already stated that the discharge of gas through small orifices is as the square root of the pressure, but that this does not hold good with fishtail and batwing burners below six or seven-tenths pressure; for, in this case, the discharge seems to be almost directly as the pressure. In order to substantiate this remark, I subjoin the following tables of experiments made with batwing burners, consuming both cannel and common gas, and also with a very large fishtail burner, consuming common gas only. The batwing burner employed, and which I have called No. 1, is made to consume 5 feet of cannel gas; and it will be seen that when that quantity is consumed per hour, the greatest value for one foot of gas in standard candles is obtained; and it will also be observed that such a burner is not at all adapted for the combustion of common gas. The fishtail burner is of very large size, and might well be compared with the double batwing burner, which gives a result equal to the Argand. In constructing the following tables, a pressure-gauge was employed, on which the two-hundredth of an inch is easily recorded, and the most sensitive governors were used. The gas was tested, before commencing the experiments, with a 15-hole Argand burner, and was found to equal 14 standard candles. A jet of Cannel gas was now substituted for the candle, and, after each burner had been experimented upon, this jet was compared with the standard Argand, as at the commencement. Some small variations occurred in the illuminating power of the gas, which were corrected by adjusting the jet so that the Argand burner always gave a light fourteen times larger than the jet. The results obtained therefore show the comparative value of the various burners examined.

Burner.	Pressure.	Illuminating power, in Standard Candles.	Value of 1 foot of Standard Candles.	Gas Consumed. Actual in feet.	Gas Consumed. Calculated —in feet.
Newcastle Gas.					
Large Fishtail.	10 tenths.	15·64	1·70	9·2	..
	9 "	15·16	1·78	8·5	8·73
	8 "	14·58	1·82	8·0	8·23
	7 "	16·33	2 15	7·6	7·70
	6 "	18·66	2·66	7·0	7 13
	5 "	15·98	2·57	6·2	6·50
	4 "	14·00	2·54	5·5	5·83
	3 "	10·50	2·33	4·5	5·03
	2 "	7 87	2·24	3·5	4·10
	1 "	4 66	2·02	2·3	2·21
Large Batwing, No. 1.	10 tenths	9·5	1·58	6·0	..
	9 "	8·7	1·58	5·5	5.69
	8 "	8·0	1·54	5·2	5·36
	7 "	6 9	1·53	4·5	5·01
	6 "	6·1	1·49	4·1	4·64
	5 "	5·3	1·44	3·7	4·24
	4 "	4·5	1·45	3·1	3·79
	3 "	3·6	1·44	2 5	3·28
	2 "	2·4	1·33	1·8	2·68
	1 "	1·0	1·00	1·0	1·89
Large Batwing, No. 2.	10 tenths	14·0	1·70	8·2	..
	9 "	13 2	1·71	7·7	7·77
	8 "	12 3	1·73	7·1	7 33
	7 "	11·0	1·77	6·2	6 85
	6 "	9 8	1·78	5·5	6·35
	5 "	8·75	1·86	4·7	5·79
	4 "	7·00	1·79	3·9	5·18
	3 "	5·5	1·77	3·1	4·49
	2 "	3·7	1·68	2·2	3·66
	1 "	1·8	1·50	1·2	2·59
Cannel Gas.					
Large Batwing, No. 1.	10 tenths.	29·03	5·58	5·2	..
	9 "	25·20	5·04	5.0	4·93
	8 "	21·00	4·66	4·5	4·74
	7 "	18·43	4·39	4·2	4·34
	6 "	15·50	4.19	3·7	4·02
	5 "	13·12	4·10	3·2	3·67
	4 "	10·50	4 03	2·6	3·28
	3 "	8 00	4·00	2·0	2·74
	2 "	4·30	3·30	1·3	2·32
	1 "	2 00	2·66	0·76	1·64

The large slot Argand burner used in the following table is constructed to consume 7 feet per hour with a 7-inch chimney, and the 15-hole Argand is the ordinary Parliamentary burner, as first made in 1859.

Burner. (Newcastle Gas)	Pressure.	Illuminating power.	Value of 1 foot of Gas in Standard Candles.	Gas Consumed. Actual, in feet	Gas Consumed. Calculated —in feet.
Large Slot Argand, 7-in. chimney.	3·6 tenths	22·00	3 14	7·0	..
	3·0 "	18·50	2·93	6·3	6·39
	2 5 "	14·25	2·64	5·4	5·83
	2·0 "	12 50	2·55	4·9	5·21
	1·5 "	9 00	2·14	4·2	4·51
	1·0 "	5·50	1·57	3·5	3·69
15-Hole Argand, 7-in. chimney.	0·45 "	14·0	2·80	5·0	..
	0·35 "	10·7	2·54	4·2	4·40
	0 20 "	6·8	2 06	3 3	3·33
	0·09 "	2 6	1·17	2·2	2 24
	0·06 "	1 0	0·55	1·8	1·82

In comparing the results thus tabulated, it is very interesting to note the difference in the value of 1 foot of gas in standard candles when consumed in the largest size batwing and fishtail burners. With the former, it is 1·88, with the latter, 2·66 candles. The fishtail burner, in fact, when the holes are of large diameter, is nearly equal to the double batwing, and very little behind the best results obtained from the Argand burner.

The following table exhibits the best results obtained from each kind of burner:

Burner. (Newcastle Gas)	Pressure.	Illuminating power, in candles.	Value of 1 foot of Gas in Standard Candles.	Gas consumed.	
				Actual, in feet.	Calculated —in feet.
Large Argand Slot	3.6 tenths	22·00	3·14	7·0	..
15-Hole Argand	9·45 "	14·00	2·80	5·0	..
Double Batwing	3·7 "	13·75	2·75	5·0	..
Large Fishtail...	6· "	18·66	2·66	7·0	7·18
Large Batwing, No. 2.... ..	5· "	8·75	1·86	4·7	5·79
Ditto, No. 1....	10. "	9·50	1·58	6·0	..

It is also worthy of remark that the 15-hole Argand requires less pressure to produce the maximum illuminating power than any other burner in this table.

The following table shows the comparative value of 5 feet of gas consumed by several batwing and fishtail burners, and I have also added the double batwing burner, to show the great difference in value of 5 feet of gas consumed in the combined flame, in one distinct flame, and in two separate flames—the results being respectively 13·75, 7·60, and 8·40 standard candles.

Burner. (Newcastle Gas).	Pressure.	Illuminating power.	Value of 1 foot of Gas in Standard Candles	Gas Consumed, in feet.
Batwing Burners—				
No. 8.....	5·5 tenths	9·4	1·88	5
No. 7.	4·6 "	9·0	1·80	5
No. 6.....	10·5 "	8·0	1·60	5
No. 5.....	4·6 "	8·6	1·72	5
No. 4.....	9·7 "	5·7	1·14	5
No. 3.....	16·0 "	3·5	0·70	5
Fishtail Burners—				
No. 8.....	3·5 tenths	12·1	2·42	5
No. 6.....	6·6 "	9·3	1·86	5
No. 5.....	8·8 "	6·3	1·26	5
No. 4.....	13·9 "	5·1	1·02	5
No. 3.....	18·0 "	2·1	0·50	4·2
Double Batwing. 2. No. 5—				
Both burning.....	3·7 tenths	13·75	2·75	5
One shut off.....	9·0 "	7·60	1·52	5
Ditto.....	3·5 "	4·20	1·68	2·5

The following table is added here to show the comparative value of burners when consuming cannel gas, from which it will be seen that burners of the Argand form, though the best for Newcastle gas, are not so favorable for the combustion of gases of high illuminating power.

Burner. (Cannel Gas).	Gas Consumed, in feet.	Illuminating power, in candles.	Reduced to 5 feet per hour, in candles.	Value of 1 foot of Gas in Standard Candles.
No. 8 Batwing.....	5·0	31·0	31·0	6·20
30-hole Argand, 6-inch chimney.....	4·5	26·5	29·4	5·88
No. 4 Fishtail.....	2·5	13·0	26·0	5·20
30-hole Argand, 7-inch chimney.....	4·1	20·0	24·4	4·89
Leslie Burner, 3¼-inch chimney.....	3·1	15·0	24·2	4·83
Lava Batwing....	2·8	13·5	24·1	4·82
15-hole Argand, 6-inch chimney.....	2·8	11·5	20·5	4·10
No. 2 Batwing Burner....	3·0	12·0	20·0	4·00
15-hole Argand, 7-inch chimney.....	3·3	13·0	19·7	3·94
No. 2 Fishtail.....	2·5	8·5	17·0	3·40

It is curious to remark that, from this table, it appears that the large batwing produces the best result when consuming cannel gas, and is 57 per cent. superior to the 15-hole Argand Parliamentary burner; but when consuming common gas, the converse of this is the fact—the standard Argand burner will, from an inspection of the previous tables, be found to produce a light, from each cubic foot of gas, 50 per cent. superior to the large batwing. The above burners are not chosen for any particular advantages they may possess, but were merely some I happened to have by me.

By a careful consideration of all the conditions to be fulfilled, and a most elaborate series of experiments, Mr. Sugg has succeeded in constructing various kinds of Argand and other burners, which are, perhaps, superior to any others. The 15-hole Argand, with a lava top, of his manufacture, was used first by myself in photometrical observations, in February, 1859; and a similar burner was exhibited by Mr. George Lowe to the Committee of the House of Lords who sat on the Metropolis Gas Act, in 1860. This is the kind of burner now supplied by Mr. Sugg, with his photometers.—*Banister's Gas Manipulation.*

* It will be seen further on, in the tables of the quantities of gas discharged by ordinary gas burners, that there is a remarkable exception to this rule in the case of batwing and fishtail burners, working below six or seven-tenths pressure.

† Since the above was written, a pamphlet has been published by MM. Audouin and Berard, which fully confirms the above remark.

THE GAS COALS OF SCOTLAND.

In accordance with your request, and the promise which I made a few days ago, I have been directing my attention to the Gas Coal Fields of Scotland. It is only after doing so that I am made aware of how little positive knowledge I possess regarding them; and my remarks, if of any use at all, will only be useful in so far as they may suggest subjects of inquiry, and in directing your attention to where these inquiries may be answered. So far as regards the geological position of the most valuable gas coal beds, they are, with very few exceptions, all found interstratified with the carboniferous limestone, into what Mr. Ralph Moore, in his Section of the "Average Position of the Principal Seams of Coal and Ironstone in Lanarkshire," particularizes as the lower coal series.

Of the coals now in the market so situated, there are: Lesmahago, in the parish of that name; Wilsontown, in the parish of Carnwarth; Rigside coal, in the parish of Douglas; and to the north and west of Glasgow, the seam which has been worked for many years from the lands of Knightswood, Kelvin, Garscube, Jordanhill, and Govan. All these are in the county of Lanark; the four first-named places being upon the southern outcrop of the Lanarkshire coal beds, and the others upon the northern. In Ayrshire there is found in the same measures the gas coal from the parish of Muirkirk; from Straid, in the parish of New Cumnock; and Dalquharran, in the parish of Dailly. In the Lothains, to the South of Edinburgh, there is the Arniston coal field, the Marquis of Lothian's, and others, all in the lower coal series. In Fife, the best known gas coals, and the most valuable, are from the lower coal beds also—Wemyss, Overton, Torryburn, and Cappledrae. I am not aware whether these names indicate the same bed of coal, but I believe there is no doubt as to their position in the section of the district. The last gas coal which will be noticed of the lower series in the Kinniel, or Borrowstoness coal, in the county of Linlithgow—although I am aware that there are several other thin seams worked in connection with the iron stones. In connection with and forming a portion of the upper series of coal beds is the famous Boghead gas coal, or Torbanehill mineral. The gas coal found so abundantly in the splint coal seam of the Lanarkshire mineral basin, to the east of Glasgow, in the parish of Old Monkland, and more sparingly in other districts, where the upper coals are deposited; also a bed of gas coal (from 4 in. to 5 in. thick) which has been analyzed under the name of Monkland coal. The Lochgelly gas coal (Fife) is in the coal beds of the upper series. The bituminous shales, upon which the oil works are established at Broxburn, in the parish of Uphall, and other places, belong to the coal measures of the carboniferous limestone era. The marked characteristics of the gas coal found in the coal fields of Scotland are their variableness in thickness and quality, and the uncertainty of their continuance, in any form whatever, sufficiently marked to indicate their position.

Another noticeable feature of the gas coal beds of the lower series is their almost universal proximity to blackband ironstone, in a greater or less degree; this is also a marked one of the Boghead gas coal, which is generally found connected with ironstone, and over a large tract of country gives place to it entirely. In works published by Abraham Gesner, M. D., F. G. S., &c., New York, London and Paris, by Baillière Brothers, 1861, it is stated that Boghead coal is found interstratified with the carboniferous limestone. This is a mistake, it seems, which I may have had some hand in creating, as such was my impression until lately. It may be noticed that amongst the reasons which led me to suppose that Boghead coal belong to the limestone group, is the curious fact that the most marked external feature of Boghead and Lesmahago coal is the frequent appearance of a well-defined plant of the Cactus tribe, identically the same in both.

Whilst the vegetable origin of all coal is perfectly evident, how the description of coal now under notice, and known as gas coal, has been produced is a second mystery, remaining to be solved after the first question has been disposed of, namely, what is coal, and by what agency was it made coal from the plants of which it is composed? Supposing that pressure and heat, with electrical and chemical action combined, and continued over immense periods of time, sufficient to have produced the general change, as we find it, to have been the agency, the question still remains unanswered. Without having the slightest inclination to jump at a conclusion, which might not be borne out by a more extended and careful examination of facts, I am disposed to entertain the idea that proximity to the source of the fire rocks has had a direct influence upon the formation of gas coal. Whether this idea is correct or otherwise, we certainly find that the most extensive fields of the Scottish gas coal have originated under such circumstances, and it would also appear that the process of transformation into gas coal had been matured previous to the outbursting of more recent fire rocks, whereby the sedimentary and stratified rocks were torn up, twisted, disconnected, and forced by an immeasurable power into the position which these rocks now occupy. The Lesmahago field is an example of this kind. Admitting it to be the case that internal heat has had a direct influence upon the formation of gas coal, the phenomena in connection with it still unaccounted for are most perplexing, such as passing from one kind of coal into coal of an entirely different kind, without any seen cause or change in the roof or pavement; layers of gas coal an inch in thickness and under being found in the thick seams of cherry or splint coal, the gas coal being sometimes upon the top, at other times at the bottom, or it may be at any intermediate distance between the roof and floor of the coal bed in which it is found.

Again, as regards the ironstone bands, with which it is so often found connected, the ironstone is found sometimes upon the roof, sometimes at the bottom, or in the midst of it, and in many cases interstreaked or laminated with the coal; so diversified are these combinations, that at times there may be a difficulty in determining whether the substance under notice should be called coal or ironstone.

With these remarks as to origin and geological position, I will now glance at the Scottish gas coals from the chemical and mercantile point of view. It would seem, at first sight, that the one should regulate the other—that is, the chemical value being known, the price of the coal would be regulated accordingly. This is not always the case; the number of purchasers are few, as compared with the purchasers of other coals; and these purchasers, even where there are two or more in the same town, do not compete directly through the coals, but indirectly, as far as the coal is concerned, through the quality of the gas which the coals produce, and whether the gas company has a monopoly or not of supplying the gas. There are few individuals in the community who can discriminate correctly between cheap gas and cheap light, when contrasted with the many who consider these terms to be one and the same thing. This state of matters will always be a temptation for gas managers to prefer a cheap coal, which gives quantity, with a passable illuminating power, to those coals by which a cheaper light could be supplied, although the cost per 1,000 feet of gas, when made from these, may be considerably higher. As an example of this, last week might be seen a paragraph in the newspapers, stating that the town of Tralee was being supplied with 10-candle gas, an event which was given, it seemed, as something quite satisfactory. By 10-candle gas is meant a gas which, when used at the rate of 5 cubic feet per hour, the light given out is equal to the light of 10 sperm candles, each consuming 120 grains per hour. Compare this with the analysis of Lesmahago coal, and it will be seen that gas from such coal can be made, from which, when used at 4½ feet per hour, a light is given off equal to 36 standard candles, showing that if the one gas was worth 4s. per 1,000 feet, the other was worth 16s.; and, consequently, that Lesmanago coal—the yield of gas per ton of each being the same—is four times more valuable for lighting than the coal used at Tralee Gas-Works. The analysis of a number of Scottish gas coals are here

added, with a notice where these were made. In the case of Lesmahago coal, several analyses have been given; these are all taken from published documents, extending over a considerable number of years, and have been introduced for the purpose of showing that light, and not gas, is the true test of value. It is evident that, wherever the quantity of gas taken from a given quantity of coal is considerably increased, this is at once seen in the illuminating power.

The Scottish gas coals are also coming into notice as oil coals, having been used for that purpose, under Mr. Young's patent, for the last thirteen years. The following extracts are from Gesner's work on this subject:

Boghead coal—gas	18,000 cubic feet of sp. gr. 0.775
Or volatile matter	70.10
Carbon in coke	10.30
Ash	19.60

As an oil coal the results are 120 gallons of crude oil, from which can be made 65 gallons of lamp oil, 7 gallons of paraffin oil, 12 lbs. of pure paraffin. The coke is worthless, and the ash consists chiefly of silica and alumina. With the work from which I quote before me, may give you a quotation for some other well-known coals also:

	Volatile matter.		Coke.		Yield of crude oil per ton.
Wigan	44	..	56	..	82 gallons.
Newcastle	35	..	65	..	48 "
Boghead	70.10	..	29.90	..	120 "
Lesmahago	51.	..	49.	..	96 "
Scottish coals (cannel)	38.	..	62.	..	40 "

It has been remarked that the gas coals which contain the most ashes, the light-giving power being the same, is best adapted for the manufacture of oil. The following table, showing the proportion of gas and of coke, and also the illuminating power of gas got from the different kinds of coal, compared with that of a wax candle taken at unity, was read before the Royal Scottish Society of Arts by Andrew Fyfe, M. D., F. R. S. E., F. R. S. S. A.:

Coals.	Shadow jet 5-in. flame.	Chlorine.	Consumption 1 ft. in minutes.	Sp. gr. air 1000.	Lgth. of flame, Aldcock burn.*	Cubic feet of gas.†	Coke from 100 lbs. of coal.
Arniston	3.57	16.5	67	636	3.5	47	42 5
"	3.69	19.5	70	368	3.5	48	42.5
Average	3.63	17.5	68.5	637	3.5	47.5	42.5
Wemyss	3.86	22.	80	666	4.	45.	51.25
"	3.67	17.	70	657	3.	45.	51.25
Average	3.52	19.5	75.	662	3.5	45.	51.25
Lesmahago‡	2.98	15.75	62.5	657	3.5	45.	43.75
"	3.62	16.50	62.	644	3.25	50.	43.75
Average	3.35	16.12	68 7	650	3.37	48.5	43.75
Monkland	2.64	18.	60.	621	3.	47.	46.25
"	3.9	19.	74.	713	3.5	44.	48.75
Average	3.27	16.	67.	667	3.25	45.5	45.5
Lesmahago§	3.26	16	62	614	3.	45.	—
"	3.12	15	61	641	3.	45.	48.75
"	2.54	15	60	655	3.	44.	47.5
Average	2.88	15.33	61.	637	3.	44.66	48.125
Torryburn	295	18.	50.	633	3.5	52.	42.5
"	2.45	18.	56.	615	3.125	48.	42.5
Average	2.7	13.	57.5	624	3.33	50.	42.5
Marquis of Lothian, A.	2.75	13.	59.	633	3.5	46.	47.5
	2.6	12.5	56.	615	3.125	46.	47.5
Average	2.67	12.75	57.5	624	3.33	46.	47.5
Ditto B.	2.48	14.	60.	556	3.25	44.	44.4
"	2.43	18.	68.	536	3.	44.	55.
Average	2.45	13.5	61.5	556	3.125	44.	49.7
Knightswood	2.	8.	45.	560	25.	41.	52.5
"	1.75	10.	52.	554	25.	40.	53.
Average	1.87	9.	48.	557	25.	40.5	52.7
Skaterigg	1.98	9.	40.	478	2.78	42	57.5
"	1.80	9.	51.	521	2.5	45	52.5
Average	1.89	9.	45.5	500	2.66	46.5	55.

The following extracts from a paper by Andrew Fyfe, M. D., F. R. S. S. A., Professor of Chemistry, King's College University, Aberdeen, read before the Royal Scottish Society of Arts:

COMPARATIVE STATEMENTS.

English caking coal from Newcastle, used in London and other places*	1.† ..	4.23‡	50' 30"§	11-10ths of an inch.‖	8,000¶ 420**
Same coal, result of 8 trials, by Dr. Fyfe*	— .. 5 nearly	‡	50' 25"§	—	— 464**
Wigan Cannel Coal, used in Liverpl, Manchester, &c.*	1.93† 7.55	‡	57'§	8-10ths to 9-10ths.	9,500¶ —
Lesmahago gas coal, used in Glasgow, Edinburgh, Ab'rd'n, &c.-aver. of six trials by Dr. Fyfe.*	7.† .. 17.1	‡	65'§	—	11,020¶ 642**

Value of the coal (Lesmahago) as compared with the Skaterig coal from the same field as the Knightswood, Kelvin, Garscube, Cowdenhill, and Govan coals—the best gas coal found in the neighborhood of Glasgow—taking into account the quality and quantity of the gas:

Best Glasgow Cannel coal, Skaterig, &c., 1.06. Lesmahago, 2.02.

Analysis by A. Wright, gas engineer, Western Gas Company, London:

Coke.....per ton, lbs.	1091.
Gas	463.
Tar	594.
Ammonia and water	4.5
Loss	87.5—2240.0
Cubic feet of gas	11681
Specific gravity	.540

Residuary products per ton—tar, about 59 gallons; coke, about 33 bushels imperial.

Experiments made by Dr. Frankland, F. C. S., Manchester, on Lesmahago Coal. Gas per ton, 10,620 cubic feet; light produced being equal to 7,620 standard sperm candles.

Illuminating power at different rates of consumption, as proved by shadow test and sperm candles, each burning 10 hours, at the rate of 120 grains per hour: Gas consumed at the rate of .35 cubic feet per hour gives a light equal to the consumption in an hour of 1 candle; at 2 feet per hour, equal to 12.1 candles; at 3 feet per hour, equal to 23.2 candles; at 4 feet per hour, equal to 28.7 candles; 4½ feet per hour, equal to 36 candles.

The average results from Wigan coal, similarly treated: Gas per ton, 10,670 cubic feet; light produced equal to 4,486 sperm candles.

Comparative results: Wigan coal gas, consumed at the rate of 4 feet per hour, gives, on an average, light equal to 16 sperm candles; Lesmahago coal gas, 28.7 sperm candles.—*London Mining Journal.*

* Description of coal, and where used, &c.
† Comparative value (English caking coal) taken as unity.
‡ Condensation by chlorine, average of several trials, per cent.
§ Durability of a cubic foot, with a 4-inch flame and a jet 1-33d of an inch in diameter.
‖ Pressure by water gauge at the burner.
¶ Cubic feet per ton.
** Average specific gravity, air 1,000.

* Pressure 1 inch. † From 100 lbs. of coal. ‡ Dukes.

§ Attention was called to this, and coal sent from our work for a new analysis, which satisfied Dr. Fyfe that in the first one the specimens sent had been tampered with.

PETROLEUM ITEMS.

Receipts of Crude Oil in Pittsburg.—*Rooms of Board of Trade and Merchants' Exchange, Pittsburg, Oct.* 27, '63.—"950,000 barrels of crude petroleum, in round numbers have been received in Pittsburg from September 1st, 1862, to September 1st, 1863; and had the Allegheney river been navigable for ten months in the year, the receipts would have been one-third greater. With the exception of about ten thousand barrels, the entire amount was carried by the Allegheney river. Two-thirds of the crude petroleum at Pittsburg was refined by the refineries in and around the city, of which there are over sixty (60). Of their capacity I have no official data, but judge that, running to their full extent, they would require about 1,500,000 barrels of crude petroleum to supply their demand. The cost of transportation by river is to be estimated beyond the rate of freight. There is leakage when in barrels, and leakage and evaporation when in bulk boats. These items of cost of transportation will of course be greater or less, according to the time the oil is on its way down the river."

Petroleum *vs.* Coal.—The report of the Commission appointed by the Navy Department, consisting of three Chief Engineers, who have made careful experiments for five months, showing the practicability of using petroleum or hydro-carbon oils for the purpose of generating steam, has been issued, and proves satisfactorily, it is said by those who have seen it, that the results show a great saving, not only for merchant steamers, but that a naval steamer can keep the sea under steam three times as long, with less labor and greater economy, as compared with coals, equal weights of each being considered; thus indicating a complete revolution in the mode of generating steam.

The Petroleum Trade in Liverpool.—The imports of petroleum into Liverpool have of late been rather small, principally owing to the endeavors at present being made at the oil springs to prevent the exportation of petroleum, at the present rates, as the contracts made some time since did not include the exportation from the wells of petroleum in a refined state. The importation of crude petroleum is therefore limited, and pending the new experiment now in course of test at the wells, prices at present do not foot up more than 1s. 9d. to 1s. 10d. per gallon. The ship recently fitted up with petroleum tanks had not, up to the latest advices from America, arrived at her destination. Owners of regular trading ships in many cases will not allow their vessels to carry petroleum at all in its crude state, owing to the difficulty of cleansing the ship, after the discharge of her cargo, of the smell. This, of course, without the limit put upon the export of petroleum from the wells by the sellers, will be one of the causes of the decreased import into Liverpool. In consequence of the action of the shippers, the recent buildings erected, and in course of erection at Bootle, near Liverpool, in one case have been let for the storage of cotton, and, in the other case, where it was intended to construct machinery for the purpose of refining the petroleum, the further progress of the buildings has been brought to a rather premature termination. The opposition of the inhabitants of the northern end of Liverpool, in which Bootle is situate, may have had a great deal to do with the suspension of the imports, and there is no doubt that in future a much larger portion of the petroleum imports will be in the refined condition.

Fatal Explosion of Petroleum in England.—An explosion of American oil, attended by loss of life, took place at the village of Oxenhope, near Keighley, on Wednesday evening, November 18th. Mr. Joseph Parker, a small shopkeeper there, a short time since purchased a barrel of petroleum (upwards of thirty-one gallons), which, it appears, was sold as Young's patent paraffin oil. Having supplied a customer with two gallons of the oil, Mr. Parker very imprudently proceeded to replenish the cask fron an eighteen gallon tin by the light of a candle, placed about a yard from the running stream of inflammable liquid. His son, John William, aged seventeen, assisted him, and a younger son, Holben, was standing by. While thus engaged, Mr. Parker observed a small blue flame running quickly along the side of the barrel, and in an instant a loud explosion occurred, blowing Mr. Parker completely through the doorway. The whole house was quickly enveloped in flame. The sons, to escape the flames, made for the stairs, and succeeded in reaching a side bedroom on the first floor. The eldest jumped out of the window, and was picked up apparently lifeless. He has not since returned to consciousness, but lies in a very dangerous condition, being dreadfully burnt about the face, hands and side. The younger son was less fortunate. He was overpowered in the attempt to follow his brother, and sank upon the room-floor dead. Two daughters, Ann and Florence, aged respectively four and six years, were asleep in bed at the time in a room immediately over the shop. They were found dead, and, from the appearance of the bodies, they must have died instanly from the effects of the gas given off after explosion. Mr. Parker was badly burnt, but was able to give evidence at the inquest. The house presents a sad spectacle. The windows are forced out, and the furniture which remains is charred, as also is the whole of the interior of the building. Had it not been for the timely and hearty assistance of the neighbors, the complete block of buildings would have been destroyed. It was satisfactorily proved at the inquest that the oil was not Young's paraffin, but a cheap American petroleum.

The jury returned the following verdict: "The deceased children came to their death by suffocation, caused by the explosion or ignition of a quantity of petroleum or paraffin oil, but how the ignition was caused, there is not sufficient evidence to show;" and they added the following recommendation:—"That the jury think that too much caution cannot be used by parties dealing in petroleum oil, on account of its highly inflammable nature."—*London Ironmonger.*

Gas in Italy.—A recent letter from Naples says: "Gas-pipes are being laid down in the streets of this city. Hitherto, all the streets except three or four had been badly lighted with oil, but now gas will penetrate even into the most deserted quarters. It is a French company which has undertaken this task. Lighting by gas, extending to the whole city, is certainly a great step in advance. It must also be acknowledged that the municipality has not neglected the important question of elementary schools, as we have now at Naples nine infant schools, comprising 893 pupils, and 55 for the people, with 1,184 pupils."

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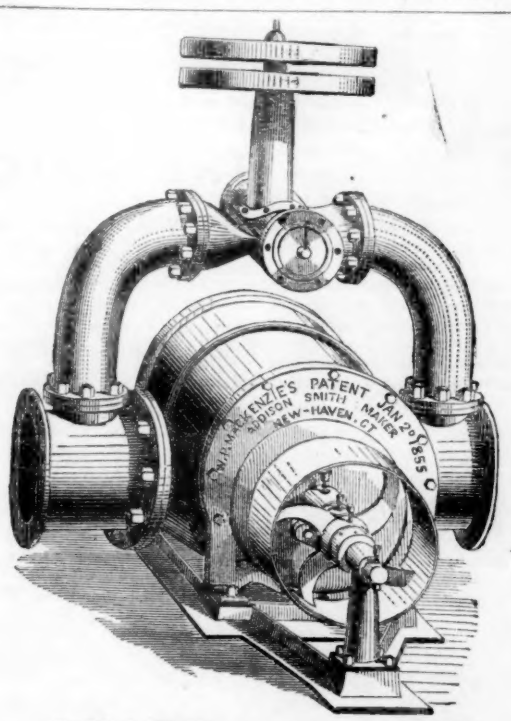

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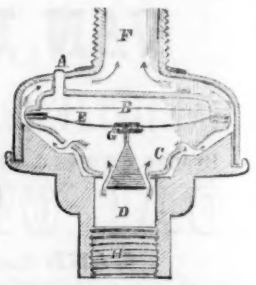

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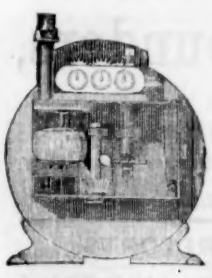

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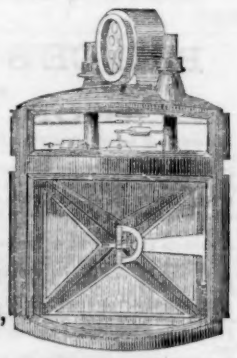

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The following illustrations, with the appended explanations, will give a good idea of the improvement:

Fig. 3.

Fig. 1.

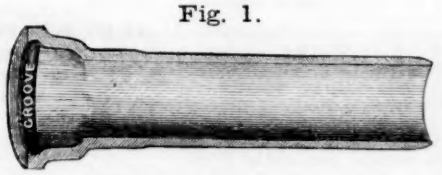

Fig. 2.

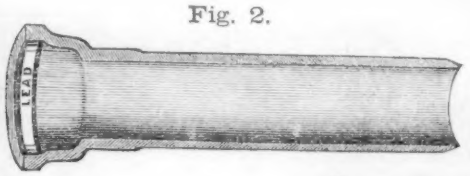

Fig. 4.

Fig. 1. Is a sectional view of a pipe showing a groove to receive a lead ring.

Fig. 2. Is a sectional view of a pipe showing a lead ring in the groove.

Fig. 3. Represents a former, which is used in the bell end of the pipe while casting the lead ring. Before using the former, however, a strip or belt of India rubber is first inserted in the socket, against which the former rests to prevent the lead escaping from the groove while being cast. Upon the cooling of the lead, the former and rubber ring are withdrawn from the socket, and the lead ring is left projecting inwards from the groove all around, forming an indestructible packing to receive the spigot-end of the pipe.

Fig. 4. Shows two pieces of pipe in connection with an hydraulic jack, by which the spigot-end of the pipe (which is cast tapering and may be cast in a chill), is forced into the lead ring in the groove which perfects the joint. A, represents the jack; B, B, the chains by which the pipes are drawn together; and C, C, pieces of pipe.

This ring joint packing may be cast at the foundry or any convenient place, and when delivered at the ditch, may be laid, and perfect joints formed, by any laborer, above or below the surface, or in ditches filled with water, there being *no joint ditching required*, and it can be laid with very great rapidity.

Among the economies realized by this joint may be enumerated, the saving in the weight of the pipe, in the amount of lead required to be used in forming the packing, in the labor of ditching, and in laying the pipe.

The bell or socket may be cast one-half the usual length, as the width of the groove requires, but from a half to one and a half inches, according to the size of the pipe, thus saving in the total weight about two hundred pounds per ton.

The weight of lead required to form this joint, as compared with the amount of lead used in forming a joint according to the old method, is fully seventy-five per cent. less, only so much being required as to maintain the compensating principle, or enough to allow (upon the raising or depressing of the line of pipe out of a direct line) what is lost upon one side of the ring packing, to take its place upon the other; thus securing flexibility of the joint without affecting its reliability. The use of yarn or hemp packing is dispensed with, the cost of which is an entire saving as compared with the old method of making joints.

The saving of labor in ditching is the total amount usually expended in digging joint-holes, there being *no joints to be caulked*.

The saving in labor in laying pipe furnished with this joint is a sum equal to the whole cost of carrying lead, fuel, ladles to the ditches, casting the lead, bailing out water, and the entire labor of caulking, less only the sum charged for casting the lead ring packing at the foundry, which is comparatively trifling. This last-mentioned economy has been estimated by the best engineers at seventy-five per cent., or the same as the saving in the quantity of lead used.

The cost of pipe cast from our patterns is the same per ton as pipe cast for the old form of joint. The principal iron-founders propose to charge the same price.

We have submitted these joints in water-pipes to a pressure of two hundred and fifty pounds to the square inch, and they have remained perfectly tight. It has also been submitted for months in gas-pipes to the ordinary pressure of our city gas-mains, without any leakage whatever. We are aware that these statements may be deemed by many extravagant, but the merits of the improvement warrant them all, and the most skeptical may be fully convinced by an investigation of its value, and by witnessing the tests to which we submit it, or by its use under any conceivable circumstances.

TESTIMONIALS.

Office of the Water Commissioners,
City Hall, Jersey City, October 14th, 1863.

Dear Sir,—On the 26th of May last, about two hundred and sixty feet of cast-iron water-pipes, six inches in diameter, with joints constructed according to your invention, were laid for the Jersey City Water-Works, in Prospect street.

The operation of uniting the joints of the pipes, was performed with remarkable facility, and with an important saving in time, materials, and labor. The joints proved perfectly water-tight, after turning the full head of water on the pipes.

In my opinion, your invention has proved entirely successful, and will be found highly beneficial to water companies.

Yours, respectfully,
ROBT. C. BACOT,
Superintendent and Engineer, Jersey City Water-Works.

Mr. R. C. Robbins.

Engineer's Office, Croton Aqueduct Department.

Dear Sir,—I have examined your plan for making joints in cast-iron water pipes, and have a report from one of my assistants, of certain experiments made by you, to prove the certainty and economy with which the joints can be made, and their stability when finished.

I think the experiments showed that the joints could be made quite as rapidly, if not more rapidly, than those made in the ordinary method now in use; the quantity of lead used was less than that required in the common joint, and no yarn packing was required. In these respects, your joint seems superior.

After the joints were made, a pressure of three hundred pounds to the square inch, was put upon the pipe in such a manner as to test the efficiency of the joint to prevent both leakage of water, and separation of the pipes from each other longitudinally. This pressure failed to produce either leakage at the joint, or separation, so long as the pipes lay in a direct line; but on deflecting them six and a half inches, in a length of twelve feet, the joint commenced leaking. It is fair to add, that this is a greater deflection than would often be found necessary in laying pipe.

I think the efficiency of the joint in both the points tested in this last experiment, might be increased by increasing the quantity of lead, both in thickness and width.

Altogether, the result of the experiments was such that I have determined to make a more thorough est of your invention by putting down about one thousand feet of pipe, when we commence our operations for the coming season.

The diameter of the pipe subjected to experiment, was six inches, and is the same size that I propose to put down next year.

I am, very respectfully, your obedient servant,
A. W. CRAVEN, Chief Engineer, &c.

To R. C. Robbins, Esq., Jersey City.

Metropolitan Gas-Works,
Engineer's Office, New York, October 9th, 1863.

Dear Sir,—The undersigned had the pleasure of being present at an experimental test of your patent joint for gas and water pipe, made at the yard of the Croton Aqueduct Department, and cheerfully testify to the results obtained, namely:

First experiment was made with two lengths of eight-inch pipe, jointed together, when a pressure of three hundred pounds to the square inch was applied. This pressure did not force the pipe apart, nor start the joints, but they remained, during this experiment, perfectly tight.

Second experiment was made by deflecting the pipe five inches, which is about equal to eighteen inches in one hundred feet, and the same pressure applied, which caused a small leak at the joints.

Third experiment was made by taking the pipes apart and rejointing them, when the same pressure was applied when lying straight and when deflected; at this experiment there was no leakage.

From these severe tests it is my impression that the superiority of your patent joint has been made manifest, and that it must eventually supersede the old way of jointing pipes together, saving both time and material.

Wishing you success in your enterprise,

I am, very respectfully, yours, &c.,
AMBROSE J. WHITE, Engineer.

To R. C. Robbins, Esq.

Office of the Metropolitan Gas-Light Company,
New York, October 9th, 1863.

Dear Sir,—Having been present at the testing of your patent joint for gas and water pipe, at the yard of the Croton Aqueduct Department, I can testify to the results as stated by Col. A. J. White, and fully concur with him in the opinion expressed in his letter to you of this date.

Very respectfully, yours,
W. Titus, Secretary.

R. C. Robbins, Esq.

New York, October 23d, 1863.

Gentlemen,—I am pleased to be able to inform you, that we are fully satisfied that we have done well in adopting your "Improved Joint," in the construction of an aqueduct which we are now building on Oil Creek, Northwestern Pennsylvania.

We have ten miles of three and four inch pipe to lay this season, and, in our estimation, the perfection of the joint, economy in lead, and rapidity with which the pipe can be laid, render it entirely preferable to any other method of laying pipe.

Our Mr. Hutchings advises us that he is putting down the three and four inch pipe at the rate of twenty-five to thirty lengths per hour, with two men in the trench. We are much pleased with this result.

Respectfully yours,
HUTCHINGS & FOSTER.

Messrs. R. C. Robbins & Co.

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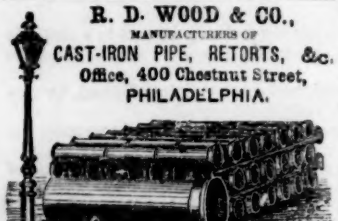

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OFFICIAL.

OFFICE OF THE NEW YORK GAS-LIGHT COMPANY,
157 and 159 Hester street, corner of Elizabeth, New York, Dec. 26, 1863.

THE ANNUAL ELECTION for thirteen Directors of this Company, will be held on Monday, the 11th day of January next, from 11 to 12 o'clock A. M., at the office of the Company.

The Transfer Book will be closed until after the election.

THOMAS K. LEES,
Secretary.

OFFICE OF THE METROPOLITAN GAS-LIGHT COMPANY,
Broadway, Corner of Forty-Second Street, New York, Dec. 26, 1863.

THE ANNUAL ELECTION of twelve Directors of this Company, will be held at their office, on Monday, the 11th of January next.

The Poll will be opened at 12 M., and closed at 2 P. M.

The Transfer Book will be closed on the evening of the 28th inst., and be opened on the morning of the 12th of January, 1864.

W. TITUS,
Secretary.

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ADJUSTABLE
GAS-BURNER.
Patented Sep. 8th, 1863.
This burner will give a good steady light under irregular pressures, and can be regulated to any size of light, thus saving gas. It will not clog up, and prevents blowing.
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Pittsburg, Dec. 21, 1863.

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